Lauren Martin and Richard Lotspeich*

# A benefit-cost framework for early intervention to prevent sex trading

**Abstract:** Prevention of juvenile sex trading in the US has risen to prominence in public policy discourse. We develop a generalized benefit-cost model to shed light on this policy issue and illustrate the framework with a case study from Minnesota. The model treats government-funded intervention as an investment project and calculates its net present value. Benefits are derived from harms avoided by reducing the extent of sex trading. The impacts of youth involvement in the market for sexual services are highly complex, and clear data on them are lacking. To account for empirical ambiguity we develop the model around a representative individual, approximate the effect of intervention on the sex market, and conduct sensitivity analysis with key model parameters. The case study evaluates seventeen distinct harms caused by sex trading based on conservative best estimates from scholarly literature. We find a large positive Net Present Value, suggesting it is in the best interest of Minnesota taxpayers to support intervention.

**Keywords:** benefit-cost analysis; intervention; public policy; sex trading; sex trafficking.

**JEL codes:** H44; I18; K42; R59.

DOI 10.1515/jbca-2013-0021

## 1 The policy problem and our framework of analysis

Recent years have seen a dramatic rise in policy attention to sex trading and sex trafficking[1] in the US. President Obama has spoken on the subject, and several

1 Also sometimes referred to as child sex trafficking, child prostitution, commercial sexual exploitation of children (CSEC), and more.

***Corresponding author: Richard Lotspeich,** Department of Economics, Indiana State University, Terre Haute, IN 47809, USA, Phone: +812-237-2176, Fax: +812-237-4349, e-mail: RickL@indstate.edu

**Lauren Martin:** Urban Research and Outreach-Engagement Center (UROC), University of Minnesota, 2001 Plymouth Avenue North, Minneapolis, MN 55411, USA

states have passed new legislation and formed multi-jurisdictional task forces to confront what they see as growing social ill.[2] According to the US State Department (2013, p. 381), "The US is a source, transit, and destination country for men, women, and children – both US citizens and foreign nationals – subjected to forced labor, debt bondage, involuntary servitude, and sex trafficking."[3] Numerous governmental and non-governmental agencies report an increase in the number of children who are victims of sex trafficking and other forms of commercial sexual exploitation.[4]

Existing policies nationwide with respect to prostitution of juveniles (and adults) has largely been one of attempted social control through criminalization. Laws related to sex trafficking treat commercial sex differently. Federal laws and some State laws related to sex trafficking view those who sell or trade sex as victims, *if* they can establish that the act of sex trading or selling was compelled through force, fraud or coercion or *if* the person selling or trading sex is a juvenile. The act of selling or trading sex is thus open to multiple legal interpretations. In most States *juveniles* who sell (or trade) sex can be either viewed as victims or prosecuted for prostitution-related crimes.

An emerging policy approach across the US views all juveniles involved in any form of sex trading as children in need of protection, rather than as criminals or delinquent juveniles. Thus far, the Federal government (Trafficking Victims Protection Act) and twelve states have enacted laws reflecting this view.[5] Several states are also in the process of developing early intervention programs to prevent youth from entry into sex trading and trafficking. Our study uses benefit-cost analysis to evaluate the social impact of such intervention. Our empirical research question is simple: What is the net gain to society of intervention to prevent sex trading among adolescents? Essentially we compare two

**2** See President Obama's speech at the Clinton Global Summit, September 25, 2012, http://www.whitehouse.gov/the-press-office/2012/09/25/remarks-president-clinton-global-initiative; According to the Polaris Project, thirty-nine states passed new laws on human trafficking in 2013, http://www.polarisproject.org/what-we-do/policy-advocacy/national-policy/state-ratings-on-human-trafficking-laws; The Federal Bureau of Investigations supports the development of taskforces to address child prostitution and trafficking, http://www.fbi.gov/about-us/investigate/vc_majorthefts/cac/innocencelost.

**3** http://www.state.gov/documents/organization/210742.pdf; p. 381.

**4** See for example, Shared Hope, http://sharedhope.org/learn/faqs/, estimate of at least 100,000 children; National Center for Missing and Exploited Children, http://www.missingkids.com/home; the Polaris Project, http://www.polarisproject.org/about-us/overview.

**5** See Polaris Project website for a list of States and a description of the policy context, http://www.polarisproject.org/what-we-do/policy-advocacy/assisting-victims/safe-harbor.

https://doi.org/10.1515/jbca-2013-0021 Published online by Cambridge University Press

"social states" (Sugden & Williams, 1978, p. 229): A society that embraces an intervention strategy against one that follows the status quo (i.e. no intervention programs).

The benefit side of our model evaluates *harms that are avoided* by preventing sex trading. This is a novel approach to the issue. According to the social science literature, sex trading causes several types of harm, including: damages to the mental and physical health of people who trade sex, reduction in their legal economic productivity during and after involvement in sex trading, burdens on public programs that address some of the personal damages incurred, law enforcement resources allocated to suppression and social control, and harm to the community environment in which sex trading occurs. The model presumes that each community has policies and expenditures that, in a piecemeal fashion, address some of these negative consequences of sex trading. To the extent that early intervention efforts are successful, harms caused by sex trading would be avoided, resulting in cost savings, which are benefits in our model.[6] The cost side of our analysis reflects resources needed to implement an intervention program. To this we also add the cost of housing because this is a critical need for many adolescents at risk for sex trading.

The phenomenon of juvenile sex trading and the markets in which sex is sold are complex and varied. Individual experiences among adolescents and their particular trajectories of sex trading vary widely. Research on this topic is difficult because the activity is hidden, dangerous, stigmatized and usually illegal.[7] While there has been a great deal of research, we found no nationally representative sample in a longitudinal study of adolescents involved in sex trading on which to base our model. In the absence of clear empirical data, our model parameters in the case study rest on conservative estimates based on the best available scholarly literature on adolescents involved in sex trading. We also perform sensitivity analysis to check robustness of conclusions. Many features of our model are unique and specific to sex trading. Our aim is to present a framework that can provide a defensible and concrete estimate of Benefit and Cost for a specific policy devoted to a complex social problem.

---

**6** It is important to be clear what "successful" means in this context. By *program success* we mean a potential sex trader is dissuaded from trading sex. But if she is replaced by another individual, total sex trading would not be diminished. By *policy success* we mean program success coupled with no, or perhaps partial, replacement. It is this latter sense that we intend here. This issue of replacement is treated fully in Section 3.

**7** See Weitzer, 2009.

https://doi.org/10.1515/jbca-2013-0021 Published online by Cambridge University Press

Policy and social debates about sex trading and sex trafficking often invoke normative, sometimes provocative, language. We try to avoid such pitfalls by using precise, objective and clear language. Prostitution, sex trafficking and sex trading are all terms used to describe a market where sexual services are exchanged for something of value. Because the first two terms have both legal and cultural connotations, we adopt the term "sex trading" to refer to all of these forms of commercial sex activity. By sex trading we mean the exchange of sexual services for payment in money, goods or services. Our analysis includes juveniles involved in sex trafficking, prostitution, survival sex, and other forms of commercial sexual exploitation. Sexual services include physical contact activities such as intercourse, oral sex, and manual sex. We exclude commercial sex shows and pornographic activity.[8]

We initially developed the benefit-cost framework with respect to the current policy environment in the State of Minnesota, although the generalized framework can be applied in other jurisdictions and contexts. In 2011 the Minnesota legislature established several new provisions related to what it terms "juvenile prostitution" and "sexually exploited youth."[9] This legislation, known as the Safe Harbor for Youth Act, represents part of a larger policy debate in the state around issues of prostitution, sex trafficking and child welfare, which is driven by heightened perceptions that juvenile sex trading is a problem that needs additional government intervention and new policy directions.[10] Runaway and homeless girls are identified as particularly at risk for involvement in sex trading, and these populations are especially targeted for intervention. Our framework is neutral with respect to gender; certainly homeless and runaway boys are also at risk of involvement. But data on the extent to which juvenile males are affected is scant, while the impact on juvenile females is better documented. Also, Minnesota policy is primarily concerned with juvenile females. So the language we use, the program we review, and the harms we consider are oriented to females. However, with minor modifications the framework could apply to either gender.

**8** While there are connections between our narrow conception of sex trading and the broader range of sex markets, there are also critical distinctions relating to legality and the nature of social harms that the activities may inflict. In our view the distinctions are paramount and justify treating the different market segments with distinct analytical frameworks. Moreover, recent policy concerns in this area are predominantly directed toward the activities we engage rather than this broader range.

**9** See Minnesota State Legislature, Special Session 1, 2011; SF0001, 2011 and HF0001, 2011.

**10** See the Humphrey School of Public Affairs, University of Minnesota, Hubert Project eCase, "Ending Child Sex Trafficking in Minnesota and US, http://www.hubertproject.org/hubert-material/238/.

https://doi.org/10.1515/jbca-2013-0021 Published online by Cambridge University Press

In applying the framework to our case study, we narrow the scope of analysis to impacts on state and local budgets. Costs are derived from an intervention program that is likely to be the model for a state-wide approach in Minnesota[11] and supplemented with estimates of shelter cost. Harms caused by sex trading are evaluated for their impacts on state and local budgets. We rely extensively on previous research about social harms associated with sex trading for the required empirical detail.

Establishing quantitative measures of the harms and their unit costs is complicated by significant variability and many uncertainties. Where evidence in the research literature is uncertain, we adopted conservative estimates so as to understate benefits. It is not practical here to present all of the assumptions and sources on which our estimates are based. We refer interested readers to our report commissioned by the Minnesota Indian Women's Resource Center (MIWRC) that utilizes the analytical model described in this article, and which contains all details on sources, estimates and our judgments of the empirical literature. It is accessible through the internet at: http://www.miwrc.org/wp-content/uploads/2013/12/Benefit-Cost-Study-Full.pdf.

We then compare these benefits (i.e. harms avoided) with costs (i.e. the intervention program and shelter) to determine net present value in dollars per client served. We find that for a representative adolescent, the cost of early intervention is on the order of a few thousand dollars, while benefits to the public budget are around a hundred thousand dollars. Although benefit estimates are subsequently refined by a number of qualifications and sensitivity analysis, our findings reveal considerable scope for positive net returns from a policy of intervention.

We review general considerations for our benefit-cost model, including issues of standing, in the next section. Section 3 specifies a quantitative model for benefit-cost calculations. In Section 4 we focus on social harms associated with sex trading and describe how we approach quantification of harms for benefit analysis. Section 5 contains the case study in which we apply our framework to the Minnesota policy context. A concluding section reviews key points and shortcomings and makes suggestions for refinement and further research.

**11** The program is the Runaway Intervention Project (RIP) currently operating in Ramsey County, Minnesota. Our case study relies on the program's budget to support the "cost" side of our benefit-cost model as well as published evaluation to ground our assumption on program effectiveness. Although the majority of RIP clients have not already been involved in such sexual activities, approximately 10% of the clients come to the program after some history of sex trading or other sexual exploitation.

https://doi.org/10.1515/jbca-2013-0021 Published online by Cambridge University Press

## 2 A broad perspective on benefits and costs; considerations of standing

In this section we present the broad framework of our model and integrate this with a general discussion of some philosophical foundations of benefit-cost analysis. We briefly discuss the market for sexual services and explore of the concept of standing in that context. This discussion sets the stage for Section 3 of the paper in which we describe our model in detail. We also explore three important externalities that are relevant but not fully integrated into our case study.

Like most public policies, the prospective youth intervention program we study has a wide range of potential economic consequences. But its core essence is a project in human capital development that will require both public and private resources. Successful intervention will result in changed behavior of youth and consequently different individual and social impacts tied to the alternative behaviors. Successful intervention will direct youth away from sexual labor markets and into alternative behaviors such as further educational investment and legitimate employment. We envision these alternative behaviors to be consistent with typical socially desired developmental trajectories of adolescents in the US.

Effects on individuals dissuaded from sex trading and prevented from becoming victims of traffickers are obviously relevant for assessing program outcomes. In a broad analysis significant benefits accrue directly to potential sex traders and trafficking victims who are dissuaded from sex-trading behavior, but benefits also flow to public and private entities that cope with negative consequences of sex trading. Dissuaded youth avoid many potentially harmful experiences such as: violence (including murder, treated below in Section 4), sexually transmitted infections, arrest and incarceration, and several significant psychological stresses that can induce minor and severe mental illnesses (as well as suicide). They will likely achieve better educational outcomes and probably higher lifetime earnings than had they engaged in sex trading.[12] When sex trading is diminished, resources that would otherwise be deployed by government and private organizations to cope with negative health and law enforcement consequences can be redirected toward other social goals.

**12** These several personal benefits from choosing not to engage in sex trading may also create substantial indirect benefit for the families of the dissuaded potential sex-trader. In some cases the youth are at risk for entering sex trading precisely because of a troubled family situation, so this indirect psychic benefit may not be relevant in all cases. But even in the context of a dysfunctional family setting there is potential for sympathy and concern.

https://doi.org/10.1515/jbca-2013-0021 Published online by Cambridge University Press

## 2.1 The market for sexual services and standing

Prevention of adolescents' entry into the market for sexual services has the potential to change the market's features. Three broad groups of actors engage in this market: buyers of sexual services, individuals supplying sexual services, and market facilitators, such as pimps and brothel owners (Farmer & Horowitz, 2013) as well as traffickers. Market facilitation can be enacted through force, fraud and coercion; thus an unknown proportion of suppliers are not voluntary participants in the market.[13] Suppliers of sexual services can be further subdivided into juveniles and adults. The policy agenda we analyze seeks to prevent the involvement of *juveniles* in commercial sex markets; it does not envision such an effort with adults. However, a trajectory of sex trading may extend from adolescence into adulthood, so modeling benefits of early intervention must consider trading behavior in later years.

If juveniles are prevented from entering the commercial sex market, it is likely that the buyers of sexual services would have to pay more due to decreased supply. This could have the effect of increasing the price for sexual services from juveniles who remain in the market and/or shifting the demand toward adult suppliers. There is currently not enough research to accurately assess the likely outcomes.[14] But we can speculate that adults and those juveniles who remain in the market to supply sexual services could see increased earnings. This could induce more entrants into the market, as well as making it more profitable for market facilitators to capture and control supply. A key question for our analysis is whether the market conditions would change such that program clients who were prevented from entering the market are simply replaced by new entrants. In Section 3 we analyze the likely impact on the market via a non-replacement coefficient. We find that some, but not total, replacement will occur and use a sensitivity analysis to evaluate the extent of non-replacement.

So with respect to market participants, some sellers may be helped, but buyers will likely pay a higher price for smaller quantity. Impact on market facilitators is not clear. On the one hand, they stand to gain from the increased price in the market, perhaps while sharing some of this with the sex traders working for them. On the other hand, they have fewer sex traders and fewer transactions from which to derive income. Traffickers, who use coercion over individuals to supply sexual services, would likely capture the entire price increase, but they may find recruitment more difficult. Thus the impact on market facilitators depends on

**13** Some studies take as a basic assumption that all involvement in commercial sex markets on the part of all sellers is not voluntary (see Farley, 2004). Others suggest that suppliers of sexual services in some market segments engage in the market by choice (see Weitzer, 2009).

**14** See for example, Monto and Milrod, 2014.

https://doi.org/10.1515/jbca-2013-0021 Published online by Cambridge University Press

particulars of the market, and we have little knowledge of these details. A benefit-cost analysis with broad scope might recognize some of these harmful results as costs of the intervention policy, just as farmers and agricultural equipment brokers might be harmed when irrigation water is diverted to other uses. But the market for sexual services is peculiar in being both illegal and disapproved by a significant portion of society. This is especially true when coercion is involved and when juveniles are suppliers of sexual services.

The concept of *standing*, a recent development in benefit-cost analysis, can assist here.[15] If actors are identified as lacking standing, then the policy consequences for them have no bearing in the computation of costs or benefits. Determination of standing is both a normative and a practical consideration: normative because the analyst decides whether actors should or should not be considered; practical because excluding actors from standing will make any analysis more tractable. Given current legal prohibitions against sex trading[16] and a dominant social outlook that condemns commercial sex, it seems quite reasonable to identify purchasers and facilitators as lacking standing for a benefit-cost analysis of an intervention program. So these cost consequences do not count because of who bears this burden.[17]

It is less clear whether standing should apply to sex traders themselves. On the one hand, adults who trade sex in most states are engaged in illegal activity that a majority of the community views negatively. If they lack standing, any costs that they incur would have no relevance. On the other hand, a victim of trafficking would clearly have standing, so any policy impacts on them should enter into the benefit-cost analysis. Social ethics increasingly view all sex traders compassionately and as victims, especially when they are adolescents. Moreover, if individuals were successfully dissuaded from trading sex, they would then clearly have standing.

This issue presents a conundrum. If one of the main benefits of intervention is the private cost they avoid because they are not trading sex, but in trading

**15** Zerbe and Bellas define standing as: "The right to have one's values counted in a benefit-cost analysis." (2006, p. 8)

**16** Sex trading is a criminal offense in all of the US, with the exception of certain counties in Nevada. In the *Model Penal Code*, a template on which many state criminal laws are based, most all activities related to commercial sex are identified as criminal offenses (American Law Institute, 1962).

**17** In this context we maintain that a binary approach to standing is appropriate. Individuals have it, or they do not. This is often adopted in benefit-cost studies. But in a broader scope, say one that includes punishment of criminals, a more nuanced treatment of standing may be required. This must be tied to broader social concerns for justice in which even convicted criminals may have some rights guaranteed by law. The eighth amendment to the US Constitution provides an example. We are indebted to a reviewer for pointing out this nuance.

https://doi.org/10.1515/jbca-2013-0021 Published online by Cambridge University Press

sex they lose standing, should that avoided cost enter the analysis as a benefit or not? Our view is that the most reasonable solution is to admit standing for all sex traders, whether or not they are victims of trafficking. Thus all instances of avoided harms to them should be considered as benefits of the intervention program. But ultimately this is a normative choice. Since we view standing for sex traders as appropriate, we should consider more fully how an intervention program might affect their private well-being.

Benefits for potential sex traders who are dissuaded from the activity (or protected from it in the case of coerced trading) include the private costs of harms that they avoid, such as violence, infectious disease, mental distress and legal sanctions. These harms are evaluated quantitatively from a public budgetary perspective in the case study in Section 5, but they impose costs of a private nature as well. Moreover, some private costs associated with harms do not have budgetary impacts but nevertheless affect youth who trade sex. Additional costs avoided include: social stigma; the unpleasant, painful, and dangerous nature of transactional sex relationships; and the time engaged in sex trading, including time spent searching for buyers or under the control of a trafficker. Sexual activities are intensely intimate and may provoke varying degrees of disgust and physical pain, particularly in a commercial context.[18] The value of time devoted to sex trading depends on the broader set of opportunities the traders face in their community, such as employment, education and household production.

Costs born by people dissuaded from trading sex consist of the income they would have derived from it, whether received in money or in kind. Because the intervention program is not forced, clients dissuaded by it have made a willing economic choice that balances these costs against the benefits of not trading sex and, we argue, experience enhanced well-being as a result. Other program clients may, of course, evaluate their benefits and costs differently and choose to trade sex. Our model framework allows for that in the program effectiveness coefficient discussed in Section 3. For a potentially coerced sex trader, who is protected rather than dissuaded, this forgone income may be quite small, and the inference of enhanced well-being is more strongly supported.

## 2.2 Externalities

Four additional social consequences of behavior in sex markets should be considered in a broadly conceived benefit-cost analysis. These are externality effects

**18** See Zelizer (2005) for an excellent analysis of intimacy in social interactions, including sexual relations.

https://doi.org/10.1515/jbca-2013-0021 Published online by Cambridge University Press

and often constitute the policy rationales behind attempts to regulate or prohibit sex trading. One is the potential for wider transmission of sexually transmitted infections (STIs) created by commercial sex. Commercial sex will not necessarily spread infection, but epidemiological evidence supports the inference that greater activity in sex trading will spread infections more widely. Thus an additional benefit of preventing sex trading is a lower overall prevalence of disease caused by sexually transmitted infections. Our case study excludes this potential because it is extremely difficult to provide defensible quantitative estimates,[19] although it could be important for both public health budgets and social well-being in a broader sense.

The second consequence is moral or aesthetic offense in reaction to seeing or otherwise knowing that sex trading occurs. Moral disgust at the presence of sex trading is a kind of negative existence value. Some members of a community may suffer negative consequences only when sex trading is present in their neighborhoods or environs that they visit. For others, negative psychic consequences are tied to knowing that sex trading occurs anywhere in their community – or even in other communities. The reality of such moral sentiments is evident in the many laws against sex trading, stigma imposed on sex traders and market facilitators, and through the activity of non-governmental organizations that seek to "rescue" active sex traders from their circumstances. Avoided moral offense, then, is an additional social benefit from a program that successfully prevents sex trading in some degree. While a community will likely have members that are indifferent, it seems highly unlikely that anyone would want to see *more* sex trading as a way to improve the ambience of their community. Again, while recognizing the importance of this external benefit, we exclude it from the case study for practical reasons.

A third externality is an extension of this moral or aesthetic offense. In venues where sex trading is visible to the public and tied to particular locations, it may decrease property values. With the emergence of internet-based marketing for commercial sex, this issue is reduced in significance. But there remains a degree of "street walking" connected to sex trading, so this impact is still relevant. This is closely connected to the negative effects on property values that are associated with retail stores selling sexual paraphernalia and pornography.[20]

**19** Not only would this require estimates of likelihood of client infection, it would also require knowledge of clients' sexual behavior in relation to the wider community and likelihood of infection there. This is extremely elusive information.

**20** Although this negative effect on property value has an intuitive appeal and has been the basis zoning ordinances that restrict "adult" businesses, research by Paul, Linz, and Shafer (2001) strongly criticizes the scientific basis of this inference. "Those studies that are scientifically credible demonstrate either no negative secondary effects associated with adult businesses or a reversal of the presumed negative effect." (p. 355)

https://doi.org/10.1515/jbca-2013-0021 Published online by Cambridge University Press

Establishing even a rough estimate for this would require careful and clever empirical work, which we do not undertake. Moreover, these effects may be an expression of the moral/aesthetic offense discussed in the previous paragraph, so care must be taken not to double count value impacts. But to the extent that negative impacts on property values result from sex trading, reversal or attenuation of these declines can be counted among the benefits of a program designed to reduce sex trading.

Finally, a fourth externality is the emotional suffering potentially experienced by families of sex traders. Particularly in the case of juveniles, families of sex traders may experience worry, sadness and fear for their relatives. Such psychic costs are difficult to quantify and value, so they are excluded from our case study. Again, this is for pragmatic reasons rather than a conclusion that such consequences are unimportant.

# 3 Developing a quantitative model

In this section we specify a computational structure for our benefit-cost model that includes the types of costs required to implement an intervention program as well as delineation of harms avoided, which constitute benefits. We also identify three behavioral issues that have a bearing on the extent to which such a program will actually return benefits and show how these can be incorporated into the conceptual framework. These are: effectiveness of program efforts to modify adolescent behavior, efficiency of filtering potential clients to focus only on those with sex-trading potential, and the potential that dissuaded adolescents will be replaced by new market entrants. Because analysis of harms is rather complicated, we develop that in a separate section.

## 3.1 Program costs

The program we analyze can be understood as an investment project: expenditures now will yield a stream of benefits into the future, which consist of the monetary value of future harms avoided. Although intervention might involve a multi-year time frame, for simplicity we model these expenditures as occurring in an initial period, $t$=0. For each year of running the program there will be a stream of future benefits tied to a cohort of program participants. Considering several years of running a program would simply replicate these streams, so we evaluate results for an average individual in a single cohort of participants.

https://doi.org/10.1515/jbca-2013-0021 Published online by Cambridge University Press

We denote the cost of the program as *IC*. This includes government expenditures for facilities, services and personnel who work in the program as well as shelter for program clients.[21] In our model framework, cost associated with a programmatic budget refers to *new* costs rather than current expenditures that are redirected. In this broad framework *IC* would include other resources as well, such as the time of auxiliary supporters of intervention (law enforcement, child welfare workers, and private volunteers) and time committed by program clients themselves. The case study developed in Section 5 is restricted to public budgets, implying a more narrow scope for *IC*. (Moreover, for practical reasons we exclude the time of auxiliary supporters who are paid from public budgets. Thus we understate cost to an extent even within this narrow scope of the case study. However, the excluded cost is relatively minor because auxiliary supporters would be engaged with the program for only short periods of time. Diversion from their other public duties imposes only small opportunity cost.) The stream of benefits is assumed to begin in the next period, $t$=1, and to continue to a time horizon $T$. We denote per period benefits as $B_t$. Using $r$ as a discount rate, the following expression summarizes the benefit cost comparison as a net present value calculation.

$$NPV = \sum_{t=1}^{T} \frac{B_t}{(1+r)^t} - IC \tag{1}$$

## 3.2 Concept of benefits – harms avoided

While estimating *IC* is straightforward, identifying details on the benefits side is considerably more complex. The essential concept is that preventing adolescents from trading sex allows the community to avoid associated harms. This involves several considerations. First, how many clients are engaged by the intervention? We denote this as $Z$. Second, how effective is the intervention program? We adopt a simple representation of effectiveness in the form of a coefficient, $\alpha$, which denotes the fraction of program participants who have sex-trading potential and

**21** It could be argued that there is no need to consider shelter costs because some kind of housing would be provided to homeless youth even without the intervention program. We include shelter costs that are paid by governmental agencies, because safe housing is a critical component to any effective intervention project. Given some ambiguity on this point, we find it prudent to include shelter costs in calculation of *NPV* for the intervention program. Results reported for the case study in Section 5 are presented both with and without shelter costs, but emphasis is on results that include these costs.

https://doi.org/10.1515/jbca-2013-0021 Published online by Cambridge University Press

who are prevented from trading sex. Third, we must identify specific harms that arise from sex trading, describe their temporal dynamics, and assign values to them, where these values represent burdens on society that are avoided when sex trading is diminished. Details on harms are developed in the next section. Here we address three additional factors that influence $B_t$: sex trading potential of the targeted population, program filtering effectiveness, and the potential for replacement in the sex market. All these issues influence policy success, and together they constitute significant innovations that we offer to the policy literature.

## 3.3 Sex trading potential and program filtering

Accuracy in identifying and referring of appropriate clients into an intervention program has significant bearing on the program's cost-effectiveness. Even without intervention, some segment of the adolescent population engaged by the intervention might not have ever been involved in sex trading. To the extent that $Z$ contains such individuals, avoided harms cannot be claimed as program benefits. This diminishes *NPV* because some participants impose cost without returning any benefit. We use $\theta$ to represent the proportion of $Z$ that has sex trading potential. This means that $\alpha \times \theta \times Z$ represents the number of adolescents successfully prevented from engaging in sex trading as a result of participating in the intervention.

Participants are drawn from a larger adolescent population (*YP*) through a process of referral and filtering by which individuals are selected according to their potential to engage in sex trading. Although *YP* would be an identified target population of concern based on observed characteristics (say, being homeless), only some fraction of them would be potential sex traders. We use $\gamma$ as a symbol to represent this share and rely on previous empirical work to justify an estimate. For purposes of our case study, we selected three primary studies of populations of homeless and runaway youth and from these derive an estimate of 0.25 for $\gamma$ (Greene, Ennett, & Ringwalt, 1999; Saewyc, Taylor, Homma, & Ogilvie, 2008; Tyler, 2009).[22]

**22** Several studies evaluate the share of homeless female adolescents engaged in sex trading, with estimates ranging from 10% to 50% (Greene et al., 1999). We recognize that an adolescent female need not be homeless to have significant potential to enter sex trading. But estimates of sex trading potential in the empirical literature seem to be limited to homeless adolescents. Any application of our framework needs to define its own *YP* and assess its characteristics. It need not be restricted to adolescents or females, but that is the focus of our case study in Section 5.

https://doi.org/10.1515/jbca-2013-0021 Published online by Cambridge University Press

Filtering the targeted population into program clients translates $YP$ into $Z$ and $\gamma$ into $\theta$, thus transforming characteristics of the wider targeted youth population into characteristics of program clients. We use $\beta$ to represent the efficiency of filtering and assume the filtering process admits all of $\gamma YP$ (female youth that actually have sex trading potential)[23] but is imperfect in that a portion of $(1–\gamma)YP$ are also admitted. Thus $(1–\beta)(1–\gamma)YP$ denotes the number of clients admitted who have no sex trading potential. The relationships between $Z$, $YP$ and $\beta$ and between $\theta$, $\gamma$ and $\beta$ are as follows:

$$Z=\gamma YP+(1-\beta)(1-\gamma)YP \tag{2}$$

$$\theta=\frac{\gamma YP}{Z}=\frac{\gamma YP}{\gamma YP+(1-\beta)(1-\gamma)YP}=\frac{\gamma}{\gamma+(1-\beta)(1-\gamma)}=\frac{\gamma}{1-\beta(1-\gamma)} \tag{3}$$

Thus if filtering is completely ineffective ($\beta$=0), $Z$=$YP$ and $\theta$=$\gamma$. If filtering is perfect ($\beta$=1), $Z$=$\gamma$YP and $\theta$=1. Table 1 shows values for $Z$ and $\theta$ for seven assumed values of filtering efficiency, a hypothetical target population of 1000, and our estimate for $\gamma$ derived from primary research sources.

## 3.4 Potential of replacement in the sex market

Dynamics in the sex market also influence intervention benefits because one female adolescent prevented from trading sex could be replaced by another entering the market. When replacement occurs, there are no benefits because the extent of sex trading has not been reduced. We have devised an approach to incorporate this issue into the model and tied it to rough empirical information in a way that allows an approximate answer as well as sensitivity analysis.

**Table 1** Sensitivity of key parameters to filtering efficiency.

| **Filt. efficiency: $\beta$** | **1** | **0.9** | **0.7** | **0.5** | **0.3** | **0.1** | **0** |
|---|---|---|---|---|---|---|---|
| Parameter: $\theta$ | 1.00 | 0.77 | 0.53 | 0.40 | 0.32 | 0.27 | 0.25 |
| Cohort size: $Z$ | 250 | 325 | 475 | 625 | 775 | 925 | 1000 |

Assumes $YP$=1000 of which 25% are potential sex traders: $\gamma$=0.25.

**23** It is, of course, possible that some adolescents with sex trading potential who are referred to the intervention program do not become clients. But our analysis need not address this because these individuals would neither impose costs nor return any benefit. Analytically, we can treat them as outside $YP$.

https://doi.org/10.1515/jbca-2013-0021 Published online by Cambridge University Press

We bring this replacement effect into the model through a "non-replacement" coefficient, $\rho$. Specifically, $\rho$ represents the fraction of program clients who were prevented from trading sex and who are *not* replaced by new entrants. For example, suppose experience in the intervention program prevented 100 female adolescents from trading sex. If the subsequent market adjustment led to 40 new entrants, then $\rho$=0.60. The interval [0,1] bounds $\rho$, and its precise value depends on the demand and supply elasticities for sexual labor. (For details, see Appendix A.) Bringing this into the model results in the following expression for the *net* reduction in female youth trading sex as a result of the program intervention: $\alpha \times \theta \times \rho \times Z$.

The extent to which replacement would occur is an open question that ultimately must be answered by empirical research, and the existing literature provides little guidance here. Our approach considers three questions: 1) How much does the intervention program reduce the number of sex traders? 2) To what extent does this reduction increase earnings in the sex market? 3) To what extent does this earnings increase induce an increase in the number of sex traders from other sources? The analysis is illustrated in Figure 1, which shows a stable demand curve (D) and two equilibria that result from an original supply curve ($S_1$ with equilibrium $e_1$) and a supply curve shifted leftward ($S_2$ with $e_2$).

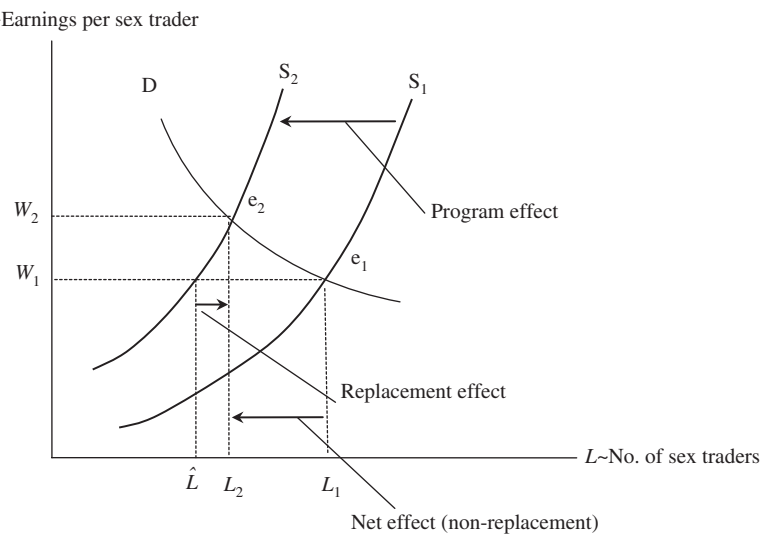


**Figure 1** Analysis of replacement effect in market for sexual labor.

https://doi.org/10.1515/jbca-2013-0021 Published online by Cambridge University Press

Impact of the intervention program is shown as the leftward shift of the supply curve. If there were no price effects, $L_1 - \hat{L}$ would also be the extent of reduction in sex trading. However, the reduction in the supply of sex traders due to the intervention can be expected to raise their earnings[24], which in turn calls forth an increase in the quantity supplied of sex traders along the supply curve $S_2$. This change from $\hat{L}$ to $L_2$ represents the replacement effect that offsets the direct impact of the intervention program, so that the net reduction in sex traders is $L_1 - L_2$. In relation to Figure 1, $\rho = \frac{L_1 - L_2}{L_1 - \hat{L}}$. The replacement effect is smaller, and the net reduction larger, when demand is more elastic and supply is less elastic.

To our knowledge, there are no studies that have attempted to measure the demand elasticity for sexual services in any venue. However, we can surmise that this would be a relatively elastic demand because sexual services are not a necessity for buyers and there are substitutes in the form of pornography, sex shows in clubs, and sexual services in other venues. In turn, this translates to a relatively elastic demand for labor to provide these services. We chose a value of –2 as a central assumption for the labor demand elasticity and undertake sensitivity analysis by also considering less elastic demands.

Again on the supply side, there is very little empirical evidence in the literature. In their analysis of street prostitution in Chicago, Levitt and Venkatesh (2007) found that the supply elasticity for sexual services was around 2, based on a 30% increase in price and 60% increase in quantity. Moreover, their observations suggested that only about one-third of the quantity increase resulted from increased numbers of sex traders, the rest coming from incumbent traders working longer hours. Using this in a rough way suggests a supply elasticity of 2/3 for sex traders. The nature of this essential labor input suggests that the supply would be relatively inelastic.[25] Lacking

**24** By "earnings" we mean payments for sexual services. These may accrue to the sex trader, or they may be captured in part or even completely by a market facilitator. The non-replacement coefficient is a feature of the market largely independent of this interesting distributional question.

**25** There are intuitive reasons to suppose this supply is relatively inelastic: social circumstances of female youth are not easily altered in a way that would induce them toward sex trading, natural population growth is slow, and inward migration may be difficult to accomplish due to both cultural and legal institutions related to youthful female populations. But ultimately this is an empirical matter and elasticities will depend on particular characteristics of the venue in which the supply reduction occurs. Is it urban or rural? Are there ethnic distinctions? Are sex traffickers extensively involved, or not? We thank a reviewer for pointing out these connections with the non-replacement coefficient, but we leave this interesting empirical issue for future research and rely on sensitivity analysis to address it in our model application.

https://doi.org/10.1515/jbca-2013-0021 Published online by Cambridge University Press

**Table 2** Values for non-replacement parameter, $\rho$, in relation to price elasticities ~1% supply reduction.

| Supply elasticity | Demand elasticity | | |
|---|---|---|---|
| | −0.5 | −1 | −2 |
| 0.2 | 0.715 | 0.834 | 0.910 |
| **0.5** | 0.501 | 0.668 | **0.801** |
| 1.0 | 0.334 | 0.501 | 0.668 |

other evidence, we assume supply is inelastic and choose 0.5 as a central value while undertaking sensitivity analysis by considering greater and lesser values (1.0 and 0.2).

Table 2 shows values of $\rho$ for three assumed values for each of the price elasticities. The calculations were based on constant elasticity forms for the demand and supply relations. (See appendix A for details.) Boldface indicates assumed values for our central estimate in the benefit calculations for the case study. Sensitivity analysis in Section 5 uses values along diagonal (lower left to upper right) with $\rho$ values at 0.334, 0.668 and 0.910.

# 4 Modeling the avoided harms

We use $H_{jt}$ to represent a quantitative measure of a harm $j$ ($j$=1, $m$) that occurs in year $t$ ($t$=1, $T$) for a single representative individual engaged in sex trading. All harms we consider occur in a probabilistic sense, so the quantified representations are expected values of harms. Specification of the units for $H_{jt}$ depends on the particular harm represented. For example, $H_{jt}$ may be the average number of days of incarceration experienced or the average loss of tax revenue from legitimate income. Some of the harms may take on integer values, but for other harms integer values are inappropriate. For example, we represent the harm of infection by HIV as the probability that a representative individual has become infected by the end of year $t$.

Clearly there will be a great deal of variability in $H_{jt}$ across individuals. The extent of harms experienced will depend on the particular environment of sex trading, the duration of sex trading activity (which we call a trajectory)

**26** Although best modeling practice would use *population averages* of the harms experienced by a representative individual, data limitations force us to use non-representative *sample means* to approximate this average.

https://doi.org/10.1515/jbca-2013-0021 Published online by Cambridge University Press

and individuals' efforts to evade harms, for example by using condoms and avoiding dangerous clients. Our case study assumes an individual experience based on a carefully constructed "average"[26] of youth engaged in sex trading.[27] The extent of harm of type *j* avoided in year *t* can then be calculated as: $\alpha \times \theta \times \rho \times Z \times H_{jt}$.

## 4.1 Venues and trajectories of sex trading

Venue, where and how sex trading happens, is crucial for estimating harms. Venues include street-based sex trading, in-call and out-call services, brothels, truck stops, etc. Research confirms that some venues are more harmful than others. In our case study we give more weight to empirical research that focuses on runaway and homeless female youth because this group was the central concern that sparked policy discussion in Minnesota. We also consider studies of adult women who traded sex as adolescents, because a proportion of adolescents engaged in sex trading will continue it into adulthood. A specific venue of reference should orient any application of our generalized model because this will shape the extent of harms.

By trajectory we mean the temporal pattern of engaging in sex trading. For example, a female adolescent might begin trading sex at age 14 and continue until age 18, or she might continue until age 28. She might also move in and out of sex trading across several years; empirical evidence suggests complexity in trajectories is common. We rely on prior studies to support reasonable assumptions with respect to the trajectory of a representative individual from the client population of adolescents, *Z*. We assume that, in the absence of intervention, the representative adolescent female would begin trading sex at age 14.[28] Our

**27** The extent of harm may be be dependent on time through changes in behavior. If females learn through experience to avoid some of the harms, the time profile would fall. On the other hand, physical injury and psychological stress may cause some women to lose ability to avoid some of the harms due to cognitive impairment (caused by factors such as drug use and traumatic brain injury) and worsening economic situation. In this case $H_{jt}$ may well rise through time for certain types of harm. Our model does not attempt to account for such changes.

**28** There is no clear and definitive scholarly evidence of an average age of first sex trade. The research literature shows a wide range of age of first sex trade for juveniles, ranging from very young to age 17. Many studies find an average age of first sex trade for juveniles between 13 and 14 years old (see Martin et al., 2010). We did not want to overestimate the degree of cumulative harm in early adolescence, therefore for our model we selected age 14 as the onset of sex trading in line with our conservative approach. Further, we believe the early intervention and prevention program will likely focus on girls around this age.

https://doi.org/10.1515/jbca-2013-0021 Published online by Cambridge University Press

assumption of trajectory duration is more complicated. If time profiles of harms were uniform across trajectories, calculation of an aggregate value of all harms could proceed on the basis of a single representative individual with an average trajectory. This is not correct, however, when the time profiles of harms depend on trajectories in complicated ways.[29]

Most information about sex trading trajectories comes from retrospective data collected from adult women about their experiences as adolescents (Dalla, 2006; DeRiviere, 2006; Martin, Hearst, & Widom, 2010; Wilson & Widom, 2010). The existing literature suggests great variability in trajectories. Many women continue sex trading into their 30s and 40s (Dalla, 2006; Martin et al., 2010). Potterat, Woodhouse, Muth, and Muth (1990) found an average of 5 years involvement in prostitution. Their conclusion is based on nearly 20 years of public health surveillance data on 1022 women engaged in sex trading in Colorado Springs, CO. On the other hand, in retrospective interviews with adults who were homeless and traded sex as adolescents, a recent study found an average trajectory of 19.9 years (Miller et al., 2011).

In the absence of clear empirical evidence from a longitudinal study, we assume a pattern of trajectories in which equal parts of a cohort would trade sex for 2, 4, 6, 8, 10 and 12 years. This implies an average duration of 7 years, which is consistent with the limited empirical evidence. If trading begins at age 14, our assumed pattern implies that two-thirds of juveniles who trade sex will continue as adults (that is, past age 18).

## 4.2 Identifying harms related to sex trading

Application of our benefit-cost model requires identification of harms caused by sex trading and specification of their prevalence, time profiles and unit costs in order to establish monetized expressions for their present values. Each specific application would have to determine harms based on its targeted population. The selection of which harms to include impacts the benefits from any policy that prevents sex trading and thus avoids harms of all types. Including more harms increases benefits and thus *NPV*.

**29** This dependence of the time profile of harms on sex trading trajectories also suggests it may be important to compare the potential trajectory of a dissuaded sex trader against one followed by a potential market replacement. Significant and persistent differences between the two groups would have implications for analysis of harms avoided, i.e., benefits in our framework. Because we have no empirical information on these differences, we have chosen not to attempt to bring this matter under review. We leave it for future research and thank an anonymous reviewer for raising the issue.

https://doi.org/10.1515/jbca-2013-0021 Published online by Cambridge University Press

Many studies have been undertaken to describe and document harms associated with sex trading among female adolescents and adult women (Vanwesenbeeck, 2001), but never quite in the quantitative way that we undertake. In this section we provide general comments that support our analysis and illustrate in more detail the harm of homicide. Readers seeking details behind the assumptions used in the case study are referred to our full report available at: http://www.miwrc.org/wp-content/uploads/2013/12/Benefit-Cost-Study-Full.pdf.

Each type of harm will have a distinct time profile that describes the value of $H_{jt}$ across the time horizon. For example, the time profile of being infected with HIV is quite different from the profile of expected days in incarceration. The time profiles of harms are determined by, yet distinct from, trajectories of sex trading. Because some harms persist after an individual ceases trading sex, the time horizon for these harms is longer than the sex trading trajectory. A striking example is the time profile for the likelihood of being infected by HIV, which rises with length of trajectory as a cumulative probability and persists until the individual's death, despite cessation of sex trading much earlier. In contrast, the profile for expected days of incarceration on prostitution charges falls to zero at the end of a trajectory.

A precise calculation would identify a continuous distribution of a sex-trading cohort across the range of possible trajectories and link it to profiles of harms unique to each trajectory. We approach this in an approximate way by assuming a discrete uniform distribution in which a cohort is equally divided into six groups with sex trading trajectories of 2, 4, 6, 8, 10 and 12 years. We use an index, $g$, to represent each of these groups, so $g$=1, 6. This is applied to the measure of harms, $H$, along with indexes $j$ and $t$. Thus $H_{gjt}$ represents the quantitative measure of harm type $j$ experienced by a member of group $g$ at time $t$. For some types of harm, $H_{gjt}$=$H_{kjt}$ for all $g$ and $k$, which simplifies calculations. But this is not true for all harms, and the model reflects these distinctions. The extent of harm $j$ experienced at $t$ by an average member of a cohort is calculated as $\left[\frac{1}{6}\right]\sum_{g=1}^{6} H_{gjt}$. Our treatment of trajectories thus defines the harm experience of a composite representative individual constructed in equal parts from all six groups of her cohort.

## 4.3 Final specification of the quantitative model

A unit cost value must be specified for every type of harm in the model. We denote these unit cost values as $V_j$, $j$=1, $m$ and assume they remain constant across time. In our case study $V_j$ consists of the amount of public expenditure required to address one unit of the harm under prevailing public policy. For example, if

https://doi.org/10.1515/jbca-2013-0021 Published online by Cambridge University Press

medical treatment is provided by a public health agency for an injury or infection, this expense constitutes the valuation. However, the unit costs may be interpreted more broadly to include private burdens as well as public expenditure. Combining the several harms with their valuations, and recognizing six distinct trajectories for a cohort, we have the following calculation for $B_t$:

$$B_t = \alpha\theta\rho Z \sum_{j=1}^{m} V_j \left[\tfrac{1}{6}\right] \sum_{g=1}^{6} H_{gjt} \tag{4}$$

Because we model the benefits of intervention using a representative individual, we can perform a benefit-cost assessment independently of knowing the variable $Z$ by considering the intervention cost $IC$ on an individual basis. A positive $NPV$ using equation (1) is equivalent to a positive value for equation (5):

$$NPV / Z = \sum_{t=1}^{T} \frac{B_t / Z}{(1+r)^t} - IC / Z \tag{5}$$

where $B_t / Z = \alpha\theta\rho \sum_{j=1}^{m} V_j \left[\tfrac{1}{6}\right] \sum_{g=1}^{6} H_{gjt}$ is derived directly from equation (4).

## 4.4 Illustration: avoided homicide as a benefit

The social science literature on sex trading has long recognized that sellers in this market incur considerable risk, including the risk of being murdered. “Prostitute women have the highest homicide victimization rate of any set of women ever studied” (Brewer et al., 2006, p. 1101). Thus an important benefit of preventing sex trading is a reduction in mortality risk. In a recent paper on safety valuation, O’Brien (2013, p. 1) notes: “For some policies involving health and safety, the value of a statistical life (*VSL*) typically accounts for the majority of the monetized benefit.” We find this is probably true in the case of sex trading. When deaths are due to homicide, law enforcement costs amplify the basic mortality harm. Our case study in Section 5 includes homicide investigation costs since this is a taxpayer burden. But we have excluded reduced mortality risk from the case study because it has no direct bearing on government budgets. Nonetheless, it is interesting to compare an estimate of the value of mortality reduction to the total of benefits that are included in the case study.

Let $p$ represent the annual probability of a typical sex trader becoming a homicide victim. Since sex trading generally occurs across a trajectory of several years, the probability of homicide in a given year of the trajectory, say year $t$, must

https://doi.org/10.1515/jbca-2013-0021 Published online by Cambridge University Press

take account of the probability of surviving the prior years: $(1–p)^{t-1}$. Calculation of the benefit of reduced mortality risk from avoided homicide (*BAH*) in year *t* of a trajectory is expressed as $BAH_t = (1-p)^{t-1} \times p \times VSL$.

We rely on Aldy and Viscusi (2008) to find an estimate for *VSL*. Theirs is based on hedonic regression using labor market data disaggregated by age group. We use the figure they report for the youngest age group (18–24 years) and the most recent cross-section for which they make the computation (year 2000). The *VSL* for this age group is $3.74 million current dollars, which becomes $4.79 million in constant $2011.[30] Epidemiological research by Potterat et al. (2004) provides an estimate of the annual homicide probability for sex traders at 0.216% ($p$=0.00216).[31] Following the structure of our model, and using our middle estimate of the discount rate (see Section 5), the net present value of avoided homicide risk for a representative individual comes to $64,287. Our estimate for the present value of all benefits to government budgets is $137,511. Including avoided homicide risk would increase the calculated benefits by about 47%, and this would represent the largest single source of benefit.

## 4.5 Summary comments on harms

Any attempt to calculate the value of harms from sex trading is fraught with uncertainty and inaccuracy. This applies to both quantifying the harms ($H_{jgt}$) as well as establishing unit costs ($V_j$). In our case study we were forced to make decisions. Where choices had to be made regarding larger and smaller figures, we chose in a way to understate the benefit calculation in our model. For example, we know that physical, psychological and legal harms from sex trading also reduce earnings potential and thus burden the public budget through increased income support. We have excluded this from our calculations. We know that several sexually transmitted infections are associated with

**30** Estimates of *VSL* have a large variability from study to study and even within the same study. Aldy and Viscusi (2008) provide eight different estimates, each based on a different year of data. These range from $0.95 to $6.45 (millions of 2000 dollars). The simple average of the estimates is $4.68 million ($5.98 million in 2011 dollars). Thus the *VSL* value we use to estimate the benefit of avoided homicide is in the low range.

**31** Potterat et al. calculate a crude mortality rate for homicide during active sex trading at 229 per 100,000 person-years, and they also report a standardized mortality ratio for this cohort at 17.7. We used the ratio to adjust the mortality rate downward to 216 as a way to account for the probability of homicide in the general population. Thus the figure 216 per 100,000 represents the *increased* risk attributable to active sex trading.

https://doi.org/10.1515/jbca-2013-0021 Published online by Cambridge University Press

sex trading, but we include only HIV/AIDS and Chlamydia because we could find reasonable epidemiological data for only these two STIs in connection to sex trading. Moreover, transmission of STIs from sex trading will cause disease to some degree in the broader population, as we note above in discussion of externalities, yet we exclude this. This approach of conservatism in claiming benefits from an intervention policy strengthens any conclusions that such a policy passes a benefit-cost test and casts doubt on a conclusion that it fails such a test.

# 5 Narrowing the scope – a case study for Minnesota

In this section we present a case study using the framework described above, which is oriented to the current policy context in Minnesota that was described in Section 1. We conduct a benefit-cost analysis with its scope restricted to state and local government budgets in Minnesota. All costs and benefits are restricted to public spending, and thus the case study recognizes standing only for Minnesota's citizens in their role as taxpayers. Our question is this: What is the return to the taxpayers of Minnesota if they invest in an intervention program to prevent female adolescents from engaging in sex trading? Our analysis assumes that other public policies that address harms associated with sex trading in Minnesota will continue to be followed. Thus law enforcement and health care policies connected to sex trading harms will continue. If intervention reduces sex trading, then the expenditures associated with those policies will be reduced and constitute benefits in our analysis.[32]

## 5.1 Choosing a rate of discount

Because our case study analyzes policy in the state of Minnesota, an appropriate rate of discount should reflect that state's cost of financial capital. We examined yields on Minnesota's general obligation bonds issued between 2009 and 2011, which reflect the state's cost of borrowing around the time of policy debate. The average yield was 2.38%, which we use for our central estimates of present values. We conduct sensitivity analysis by using four other discount rates. First,

32 One exception to this avoided expenditure approach to benefits is the increase in income tax revenue that would accrue when sex trading is prevented.

https://doi.org/10.1515/jbca-2013-0021 Published online by Cambridge University Press

we used discount rates higher and lower than the central estimate by 1 percentage point. Second, recognizing that these government borrowing costs are low by historical standards, we expand the sensitivity analysis by calculating present values using discount rates that may more closely reflect long term historical averages: 5% and 7%.

## 5.2 Cost analysis for Minnesota

The cost side of our analysis identifies the public resources required to operate an intervention program.[33] We derive a cost estimate based on the budget of the Runaway Intervention Project (RIP) operating in Ramsey County, Minnesota. RIP is a comprehensive intervention program that seeks to reestablish a healthy developmental trajectory for female adolescents who are at risk for sexual exploitation. This program was selected because it closely matches the criteria laid out in the Minnesota legislation, and we have published evaluation results and program descriptions, as well as cost data from program managers.[34] We supplement data from RIP with cost information on shelter provided by the Homeless Youth Services Coordinator for Minnesota to arrive at an estimate for total cost per client served by an intervention program. In the interest of brevity we exclude extensive discussion of RIP, but interested readers can find detailed description in our main report: http://www.miwrc.org/wp-content/uploads/2013/12/Benefit-Cost-Study-Full.pdf.

Program evaluation results for the most intensive components of RIP suggest that the program is highly effective at intervening with girls who have experienced high levels of sexual exploitation including rape, sex trading and trafficking. Unfortunately, we do not have effectiveness data for the less intensive components of RIP and therefore do not know how effective the overall program is in preventing female adolescents from engaging in sex trading. We address this lack of clear empirical information through sensitivity analysis that evaluates benefit of intervention with a broad range of program effectiveness, which is captured by

**33** Public service organizations like this often rely on community volunteers and NGOs as resources to supplement government funding. While we recognize such contributions to cost, our perception is that they are relatively minor for youth intervention programs like RIP and we do not incorporate them into our cost estimate.

**34** In addition to published sources we rely on personal communications with the following program staff: Laurel Edinburgh, Midwest Children's Resource Center, Children's Hospital, nurse practitioner and researcher with the Runway Intervention Project; Elizabeth Saewyc, program evaluator for RIP, University of British Columbia School of Nursing and Division of Adolescent Medicine, Vancouver, Canada; and Kathryn Richtman, Ramsey County Attorney's Office. RIP documents provided on December 9, 2011.

https://doi.org/10.1515/jbca-2013-0021 Published online by Cambridge University Press

the $\alpha$ parameter introduced in Section 3. We assume a value of 0.70 for our central estimate of effectiveness. Program evaluators considering the intensive components of RIP report a 96.7% overall effectiveness rate at preventing sexual exploitation, including sex trading.[35,36] This type of programming is likely to be similarly successful with the target population envisioned by the Minnesota Safe Harbor for Youth Act,[37] and the high rate of effectiveness for the intensive component justifies using a value of 0.70 as the central estimate for program effectiveness.

### 5.2.1 Cost estimates for intervention program

Because our conceptual framework is based on a representative individual, we calculate the cost per participant in RIP using a weighted average of component costs per individual client. All clients receive initial assessment, referral and a medical exam. A small proportion (10%) of the representative individual is presumed to need intensive intervention with higher cost. We have an empirical estimate of this per unit cost and infer the other per unit costs from the full program budget. The two proportions serve as the weights in the average cost calculation and are derived from data on the actual client base served by RIP in 2010.

We assume that the intervention requires 1 year, so costs are expressed in annual terms. Some of the work of RIP is conducted by government agencies and community non-profits that are already operating in Ramsey County. We do not include a pro-rated portion of their costs, but it is reasonable to assume that they would be operating with or without RIP in place and so their contribution to RIP programs is modest. According to published sources, the intensive component

**35** Personal communication, evaluator Dr. Elizabeth Saewyc, University of British Columbia, Vancouver, Canada, April 6, 2012.

**36** The precise concern of our research is sex trading, which is not exactly the same as sexual exploitation. Exploitation may involve rape, in which no trade occurs. More controversially, sex trading may or may not be exploitative, depending on circumstantial details and one's ethical outlook on the exercise of free will among sex traders. The researcher who provided this effectiveness estimate treats sexual exploitation as analogous to sex trading (Saewyc, MacKay, Anderson, & Drozda 2008, p. 13). For our purposes we feel a precise distinction is not necessary because the point here is to get a quantitative estimate of the effectiveness of an intervention program to change sexual behaviors. Moreover, we conduct extensive sensitivity analysis on the basis of this parameter, which we believe is adequate consideration of conceptual distinctions between sex trading and sexual exploitation.

**37** There are no specific characteristics required for members of the target population in order to qualify for assistance. The legislation focused on female adolescents living under socio-economic disadvantage, which may have a variety of causes, including homelessness and status as a runaway child.

https://doi.org/10.1515/jbca-2013-0021 Published online by Cambridge University Press

of RIP costs between $2500 and $3000 per client in a one-year program (Saewyc & Edinburgh, 2010). The total government contribution to RIP in 2010 was $318,023,[38] which served 509 clients (Saewyc, 2011, p. 2). Intensive intervention services were provided to 49 of these clients (about 10%). From this information we calculated a weighted average cost per client for intervention services and then added the cost of a medical exam, which averaged $262. This resulted in an estimated cost of $845 ($2011) per client for a representative individual.

### 5.2.2 Estimates for shelter cost

Most clients served by RIP do not require housing because the program serves youth who can be reunited with their family. But much of the target population of the Safe Harbor for Youth Act is homeless, and the expense to provide shelter should be considered in our analysis. If Minnesota social policy broadly intends to provide shelter to homeless adolescents, then housing costs are not properly a component of the intervention program as they would have been paid in any case. Yet it is not clear that all clients would receive housing support from the state if they were not participating in the program. We avoid settling this issue by presenting estimates of *NPV* both with and without shelter cost included. Most of our sensitivity analysis includes it.

The Minnesota Department of Human Services coordinates three types of shelter for youth: emergency, transitional, and supportive. Each type has a different cost and is required in a different degree. We relied on information provided by the Homeless Youth Services Coordinator for the State of Minnesota regarding cost estimates for each type of housing as well as an estimate of the proportion of homeless youth that would require each type.[39] These data are urban cost figures and will likely overstate the actual cost of providing shelter in a statewide program. Around half of all homeless and runaway youth will require only emergency shelter before finding stable housing that does not require government subsidy.

Based on this information we have the following cost components for 1 year for a representative client: *Emergency shelter*: $160 per day for 28 days, for all clients; *Transitional shelter*: $87 per day for 337 days (i.e. the remainder of a year), for approximately 35% of clients; and *Supportive shelter*: $51 per day for 337 days,

**38** Personal communication, Kathryn Richtman, Ramsey County Attorney, personal communication, Dec. 12, 2011.

**39** Data from Beth Holger-Ambrose, Homeless Youth Services Coordinator, Minnesota Department of Human Services, personal communication, February 14 and 15, 2012. Figures are for 2011.

https://doi.org/10.1515/jbca-2013-0021 Published online by Cambridge University Press

for approximately 15% of clients. While these figures imply a substantial shelter cost, the State of Minnesota pays only a fraction of these costs, the rest being subsidized by the federal government. In 2011 Minnesota contributed nothing to the budget for supportive shelter, about 5.2% of the transitional shelter budget, and about 8.4% of the emergency shelter budget. Applying these proportions to the three daily rates, we have the following as the State of Minnesota's share of the daily shelter costs per program client: emergency shelter, $13.44; transitional shelter, $4.52; supportive shelter, $0.0.

The burden on Minnesota taxpayers is somewhat higher because they contribute to the federal budget that provides the shelter subsidy.[40] Data from the Internal Revenue Service[41] show that over the past 10 years Minnesota contributed about 3% of the total Internal Revenue collections by the federal government. Prorating the federal contribution to shelter costs at 3% results in the following additional daily costs to Minnesota citizens: emergency shelter, $4.40; transitional housing, $2.47; supportive housing, $1.53. In sum, we have the following estimate for annual shelter cost for a representative individual:

$$\begin{aligned} Shelter\,Cost = 28\times(\$13.44+\$4.40)+337\times[0.35\times(\$4.52+\$2.47) \\ +0.15\times\$1.53]=\$1402. \end{aligned}$$

Combining intervention programming and shelter components, we estimate the annual cost of the intervention program per typical client will be approximately $2247.

## 5.3 Harms analysis for Minnesota

We organize harms that impact the government budget into four categories: (1) public health (violence, pregnancy, sexually transmitted infections, chemical

**40** This expense was not included in our original report for MIWRC. We thank an anonymous reviewer for bringing this omission to our attention. Inclusion of this cost for intervention reduces *NPV* results somewhat, but it does not alter our basic conclusions.

**41** *IRS Data Book*, Table 5. Accessed on 29 December 2013.http://www.irs.gov/uac/SOI-Tax-Stats-Gross-Collections,-by-Type-of-Tax-and-State,-Fiscal-Year-IRS-Data-Book-Table-5

**42** We thank an anonymous reviewer for pointing out the lack of this particular harm in our original model. The probabilities used are the same as in the illustration of mortality risk in Section 2 above. For unit cost we relied on the professional opinions of retired police detectives to drive a rough estimate of $10,000. They cautioned us that the cost of a homicide investigation can vary widely. If we increase this unit cost to $40,000, it increases the aggregate benefit by only about 0.3%. Thus our conclusions are not very sensitive to this particular unit cost, which can be understood to also cover any public expense for burial or cremation.

https://doi.org/10.1515/jbca-2013-0021 Published online by Cambridge University Press

dependency and other mental health problems); (2) criminal justice (homicide investigations[42], arrests, court proceedings, and corrections); (3) social welfare programs (child protection, medical assistance and income support) and (4) reduced income tax revenue.[43] Table 3 provides a summary description of the harms utilized in the case study.[44] We include only harms that have reasonable scientific backing as having been *caused* by sex trading and for which we have reliable quantitative data. The literature is mixed on whether chemical dependency leads to sex trading or was caused by sex trading (Dalla, 2006; Graham & Wish, 1994; McClanahan, McClelland, Abram, & Teplin, 1999; Surratt, Inciardi, Kurtz, & Kiley, 2004). We believe the evidence supports an inference of causality in both directions, leading us to include chemical dependency as a harm.

Harms associated with sex trading identified in the medical and social science literature but which we have decided *not* to evaluate for the case study include: reduced neighborhood quality resulting from the presence of sex trading, several types of sexually transmitted infections (we consider only HIV/AIDS and Chlamydia[45]), pain and suffering resulting from assaults, individual risk from homicide, diminished lifetime earnings and increased need for public income support, mental health problems such as chronic depression and reduced cognitive capacity (we consider only post-traumatic stress disorder and chemical dependency), and the transfer of harms of many types across generations.

Table 3 is based on an assumed trajectory of 8 years for illustrative purposes, so the pattern of harms shown represents only 1/6 of our composite representative individual. The computational model includes 5 additional patterns of harms based on the other 5 assumed trajectories. Only the harm of HIV/AIDS persists

**43** We exclude consideration of sales tax revenue because a youth would pay roughly equivalent amounts whether she earned income from sex trading or legitimate employment. But only in the latter case would government collect *income* tax from her.

**44** With the exception of homicide investigation, specific figures contained in Table 3 and used in our calculations were derived from a broad range of empirical literature, which is too extensive to review in the present paper. Interested readers are directed to our full report for complete information behind all the numbers. Available at: http://www.miwrc.org/about-us-section-benefit-cost-study.

**45** In our review of the epidemiological literature specific to sex trading, we were unable to find reliable statistical evidence relating to other STIs, such as gonorrhea and syphilis. We accept this as a flaw in our empirical application, which, if addressed, would strengthen our overall conclusion that an intervention program returns a positive *NPV*. In a similar vein, we have excluded transmission of all STIs to the broader community, an externality discussed above. While the rate of transmission between sex traders and clients might be reasonably identified, subsequent transmission depends on sexual behavior between clients and other members of the community. Our judgment is that the necessary quantitative information to include this externality as a harm is too fraught with uncertainty.

https://doi.org/10.1515/jbca-2013-0021 Published online by Cambridge University Press

https://doi.org/10.1515/jbca-2013-0021 Published online by Cambridge University Press

**Table 3** Summary of harms descriptions – Illustration assumes 8 year sex trading trajectory starting at age 14.

| Class and type of Harm | Unit of measure (expected values) | Estimate of unit cost* ($) | Time profile (d) | Harm quantity | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | Year 1 | Year 4 | Year 8 | Year 11 | Year 12 |
| Public Health Expenditures | | | | | | | | |
| Injury from Assault | | | | | | | | |
| Minor (a) | Prob. of incidence | 4433 | During trajectory | 0.20 | 0.20 | 0.20 | 0 | 0 |
| Major | Prob. of incidence | 64,174 | During trajectory | 0.05 | 0.05 | 0.05 | 0 | 0 |
| PTSD | Prob. of incidence | 6159 | During trajectory | 0.05 | 0.05 | 0.05 | 0 | 0 |
| STI's | | | | | | | | |
| Chlamydia-early treatment | Prob. of incidence | 108 | During trajectory | 0.138 | 0.138 | 0.138 | 0 | 0 |
| Chlamydia-late treatment | Prob. of incidence | 1334 | During trajectory w/3 yr lag | 0 | 0.138 | 0.138 | 0.138 | 0 |
| HIV/AIDS | Prob. of infected state | 27,309 | Persists until death at age 44 | 0.014 | 0.055 | 0.107 | 0.107 | 0.107 |
| Pregnancy with abortion | Prob. of incidence | 635 | During trajectory | 0.08 | 0.08 | 0.08 | 0 | 0 |
| Pregnancy with birth (c) | Prob. of incidence | 13,855 | During trajectory | 0.08 | 0.08 | 0.08 | 0 | 0 |
| Chemical dependency | Prob. of incidence | 37,102 | During trajectory | 0.16 | 0.16 | 0.29 | 0 | 0 |
| Criminal Justice Expenditures (b) | | | | | | | | |
| Homicide investigation | Prob. of incidence | 10,000 | During trajectory | 0.0022 | 0.0021 | 0.0021 | 0 | 0 |
| Adolescents: Arrests | Prob. of incidence | 2196 | During trajectory | 0.05 | 0.05 | 0 | 0 | 0 |
| Adults | | | | | | | | |
| Arrests | Prob. of incidence | 2,196 | During trajectory | 0 | 0 | 0.05 | 0 | 0 |
| Court hearings | Prob. of incidence | 579 | During trajectory | 0 | 0 | 0.05 | 0 | 0 |
| Incarceration | Days | 90 | During trajectory | 0 | 0 | 3.66 | 0 | 0 |
| Probation supervision | No. of sentences | 886 | During trajectory | 0 | 0 | 0.03 | 0 | 0 |
| Child Foster Care Expenditures | Child-years | 7969 | During trajectory | 0 | 0.083 | 0.166 | 0 | 0 |
| Forgone Income Tax Revenue | Dollars | 1 | During trajectory after age 16 | 0 | 1118 | 1118 | 0 | 0 |

*Unit costs are expressed in 2011 dollars.

(a) Minor injuries require medical attenti on but no hospitalization. Major injuries require hospitalization.

(b) Assumes trading starts at age 14 and adult treatment under law enforcement begins in year 5.

(c) Includes public expense for prenatal care, delivery, postpartum care and infant Medicaid cost for first year of life.

(d) During trajectory means the harm is incurred when the individual is active in sex trading.

beyond the last year reported in Table 3. Of the five types of harm associated with criminal justice, only homicide investigation and arrest apply to sex traders who are juveniles, because law enforcement practice in Minnesota will not prosecute juveniles for charges related to sex trading. But they might still be arrested and released, and they are potential homicide victims.

Our primary intention in this paper is to report on our analytical approach, so we have chosen to exclude the lengthy considerations and rationales behind the quantitative information in Table 3.[46] However, to provide readers with some indication of our method, we replicate the full report section for the harm of HIV/AIDS. (Complete explanations of assumptions and sources of empirical information are available from the authors.)

### 5.3.1 Illustration: empirical background for HIV/AIDS as an avoided harm

Trading sex increases the likelihood of contracting any STI, including HIV/AIDS. Condom use could remediate some of this harm, but condom use is not universal, particularly in sex trading venues where the sex trader has limited control. A nationally representative sample of adolescents in the US found that 19.8% of girls who traded sex had been told by a doctor that they had HIV or another STI compared to 4.1% of girls who did not trade sex, clear evidence that infections can be directly attributable to sex trading (Edwards, Iritani, & Hallfors, 2006).

The prevalence of HIV/AIDS among adolescents and adults who trade sex is extremely variable by study and locale ranging from 2% in a self-reported study of youth who trade sex in New York City (Curtis et al., 2008) to 78% in an international brothel context (Willis & Levy, 2002). Self-reported positive HIV rates tend to be much lower than rates reported from testing. In a sample of women who use drugs in a street-based sex-trading context in Miami, Kurtz et al. (2005) found that 22.4% were HIV positive. A study of 255 women in Vancouver, BC who had been street-entrenched youth found that 23% were HIV positive (Miller et al., 2011).

**46** The last harm in this table, forgone income tax revenue, is sensitive to assumptions regarding educational attainment. The annual harm value of $1118 reflects an assumption that earnings in the absence of sex trading would be for a female population with no higher education and of which 89% complete high school. We have considered lower values for high school completion of 80% and 60%. These imply annual forgone income tax revenues of $1059 and $928, respectively. When aggregated to the present value of the stream of benefits, these alternative assumptions reduce the total by about 0.2% and 0.6%, which is trivial in relation to our overall results. Our conclusions are robust to alternative assumptions regarding educational attainment.

https://doi.org/10.1515/jbca-2013-0021 Published online by Cambridge University Press

A focus on Minnesota data seems prudent given the variability of HIV rates across the US. In Minnesota the rates of HIV among all adolescents are low, close to 0%, with only 232 known cases (Minnesota Department of Health, 2011). A 2000 needs assessment study of sex traders in the Twin Cities, conducted by the Hennepin County Community Health Department, found that 13% of respondents self-reported being HIV positive (Persell, 2000). For the purposes of our model, we need the annual probability of becoming infected with HIV, in order to calculate a cumulative probability that a person will be in a state of being HIV positive in any given year of their trajectory and beyond. The study by the county health department does not indicate how long the respondents had been engaged in sex trading. However, if we presume active sex trading across 10 years, an annual probability of around 1.4% would result in the cumulative likelihood of 13%. We employ this annual probability in our model with respect to the HIV/AIDS harm.[47]

The quantitative representation of the harm is the cumulative probability of being infected by HIV, which we assume will be revealed through testing and followed by treatment with anti-retroviral therapy (ART) as well as treatment for consequences of AIDS. The time profile for this harm is rather complex because it depends on trajectories of sex trading and will be present for the remainder of an infected individual's life. We specify different time profiles for each of the six cohort groups in accordance with the groups' distinct trajectories.

We make a simplifying assumption regarding the end of these time profiles, which we presume is precipitated by death of the individual. Antiretroviral therapy for people infected with HIV continues to evolve, and this changes the cost of medical treatment and life expectancy, both of which are used to calculate benefits in our model. We use the most current and authoritative estimates (Sloan et al., 2012). Sloan et al. use an HIV simulation model (CEPAC: Cost Effectiveness of Prevent AIDS Complications) to analyze sensitivity of survival and therapy costs to particular features of disease etiology, such as the evident extent of infection at the time a patient presents to care. They also speculate that, despite the emergence of generic drugs for ART that will lower pharmaceutical costs, lifetime cost of care for HIV positive patients will likely increase in future as they have over recent decades.

**47** We recognize that the data supporting this assumed value that is used in the model is suggestive rather than definitive. HIV infection may arise from other behaviors such as drug use; however, we believe that the epidemiological evidence supports an inference that, to some extent, sex trading is a causal factor in the prevalence of HIV infection. We use the only observations we have to derive a workable assumption on the probability of becoming infected as a result of trading sex.

https://doi.org/10.1515/jbca-2013-0021 Published online by Cambridge University Press

For the sake of our analysis we adopt their "base case" for survival (26.5 years, p. 45) and annual cost per patient.[48] These calculations result in annual cost per patient of $27,309 ($2011),[49] which becomes the unit value that we apply to the probability of being HIV positive as a result of sex trading. We truncate the survival estimate to 26 years, which imposes a slight downward bias to our benefit calculations.

Using the survival time of 26 years, and assuming sex trading begins at age 14, if an individual became infected in the first year, they are expected to die by age 40. Because new infections may be contracted by a cohort through year 12, some individuals will be expected to die of AIDS as late as age 52. Since our model implies half the HIV infections in a cohort will be incurred by year 4 of the trajectories, we use the expected death year for individuals infected in year 4 as the assumed truncation year for all HIV profiles. This is year 30 from the start of sex trading, when the representative individual has reached age 44.

## 5.4 Patterns of the budgetary benefits in the Minnesota case study

The benefit side of our model is rather complex; therefore it is useful to consider the information partly disaggregated. Figure 2 shows the pattern of benefits per individual client over the time horizon of the model. The graph represents the present value of harms avoided in each year aggregated across all types, using a discount rate of 2.38%, program effectiveness at 70% and other parameter values set as in Table 4. Most of the benefits accrue in early years, and the gradual step down pattern follows from our assumption on trajectories, as 1/6 of the hypothetical cohort falls out of sex trading every 2 years. The only harms extending beyond year 12 are long-term Chlamydia infection and HIV/AIDS.

**48** Sloan et al. report annual cost at 20,170 in constant 2010 euros (p. 54). We converted this to dollars using the average 2010 dollar/euro exchange rate (1.326 $/euro) and then inflated the converted figure to $2011 using the U.S. GDP deflator. The exchange rate was calculated from daily rates reported by the European Central Bank. Accessed on 29 May 2012 from: http://www.ecb.int/stats/exchange/eurofxref/html/index.en.html.

**49** This annual cost of HIV/AIDS therapy is quite close to an estimate by Schackman et al. (2006) based on the U.S. health care system using 2004 data (Schackman et al., 2006). Using the same simulation model, their base case estimate of annual treatment cost is $25,574 in 2004 dollars. Adjusting to 2011 dollars results in a cost of $29,933. We choose to rely on Sloan et al. because their research is more recent and the cost estimate is somewhat lower, which is part of our attempt to be conservative in the assessment of benefits in our model.

https://doi.org/10.1515/jbca-2013-0021 Published online by Cambridge University Press

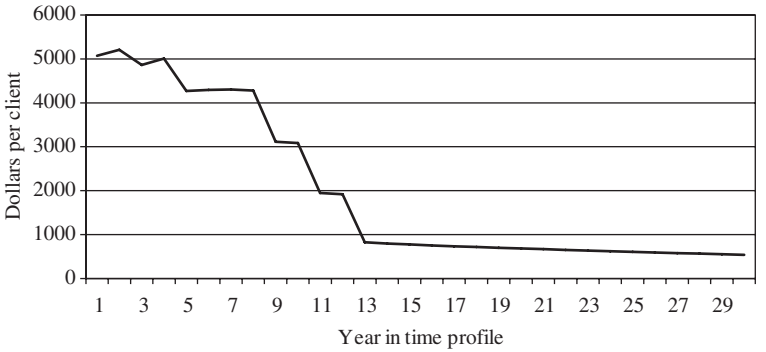


**Figure 2** Time profile of aggregate benefit per client ~ present value.

Figure 3 shows the composition of the present value of harms by major type. These values are based on the same parameter settings used for Figure 2. This perspective shows that the main sources of benefits from an intervention lie in avoided public health spending. If we include the assault-related harms as part of public health, these account for 90% of the benefits that would accrue from dissuading adolescent females away from sex trading.

Table 4 shows estimates of the present value of benefits for one representative client for six assumed values of program effectiveness and six discount rates. These numbers are based on equation 5, but exclude program cost per client ($IC/Z$). As noted in Section 3, the benefit calculations take into account the effectiveness of filtering youth into the program in order to induct participants who have potential to engage in sex trading and divert others. Calculations for Table 4 assume 90% efficiency in filtering, which means the $\theta$ parameter is set at 0.77. (See Table 1). Benefit calculations also address the market replacement problem. Results in Table 4 use

**Table 4** Model results: present value of budgetary benefits in $ per client.

| Discount rate | Effectiveness parameter | | | | | |
|---|---|---|---|---|---|---|
| | $\alpha$=1 | $\alpha$=0.90 | $\alpha$=0.70 | $\alpha$=0.50 | $\alpha$=0.30 | $\alpha$=0.10 |
| 1.38% | 92,589 | 83,330 | 64,812 | 46,294 | 27,777 | 9259 |
| **2.38%** | 84,813 | 76,331 | **59,369** | 42,406 | 25,444 | 8481 |
| 3.38% | 78,135 | 70,321 | 54,694 | 39,067 | 23,440 | 7813 |
| 5.0% | 69,168 | 62,252 | 48,418 | 34,584 | 20,751 | 6917 |
| 7.0% | 60,410 | 54,369 | 42,287 | 30,205 | 18,123 | 6041 |

Assumes: 90% filtering effectiveness and $\gamma$=0.25, so that $\theta$=0.77.
Assumes: demand elasticity at –2 and supply elasticity at 0.5, so $\rho$=0.801.
Central estimate in bold.

https://doi.org/10.1515/jbca-2013-0021 Published online by Cambridge University Press

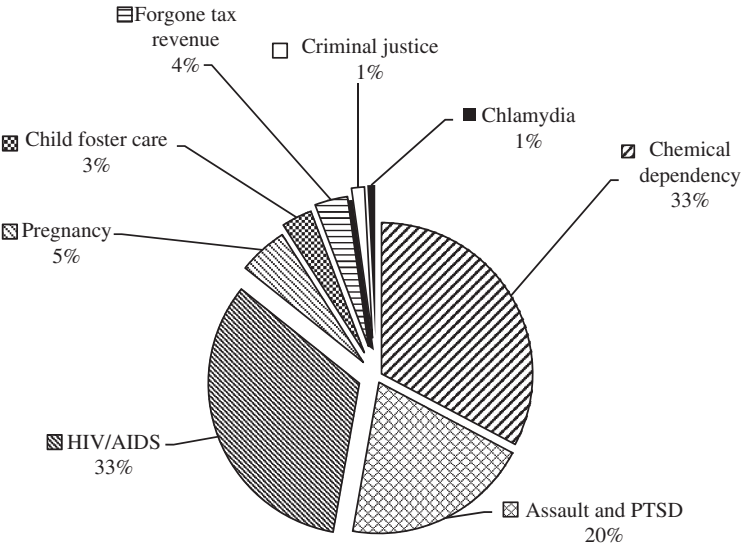


**Figure 3** Composition of aggregate benefit ~ present value.

our central assumptions for market elasticities (demand: –2.0; supply: 0.5), which result in a non-replacement coefficient, $\rho$, at 0.801. (See Table 2.)

Across the rows we vary the discount rate, with the second row using our central estimate. Across the columns we vary the effectiveness of intervention, understood to be the proportion of a cohort ($Z \times \theta$) that is prevented from engaging in sex trading. Following a conservative approach, we adopt $\alpha$=0.70 as our central assumption. Combining this with our central discount rate, our central estimate for the present value of benefits is $59,369 per client.

Sensitivity to the discount rate is modest because benefits are strongly skewed to the present; over half the total accrues by year 7. Present value of benefits falls by 6–8% for each percentage point increase of the discount rate. Because all benefits are treated alike with respect to the three model parameters (program effectiveness, $\alpha$; filtering, $\theta$; and non-replacement, $\rho$), the present value of benefits is simply proportional to each one.

## 5.5 Model results: comparing budgetary benefits with budgetary costs

For all levels of program effectiveness, our estimates show a positive *NPV* per client even when the shelter cost is included. In the central estimate case ($\alpha$=0.70 and $r$=2.38%) the program returns about $26 in avoided harm for each dollar of

https://doi.org/10.1515/jbca-2013-0021 Published online by Cambridge University Press

investment. In the most pessimistic estimate, with the lowest program effectiveness and the highest discount rate, the return is about $2.7 for each dollar of cost. Table 5 is structured similarly to Table 4, but here we subtract the estimated cost per client from the benefits in Table 4 to provide estimates of the net present value (*NPV*) per client. In the top part of this table we include the shelter costs in the calculation, while the lower part excludes shelter costs entirely.

### 5.5.1 Further sensitivity analysis

Table 6 presents further sensitivity analysis with respect to assumptions on filtering efficiency and market elasticities. These results are *NPV* calculations analogous to part A of Table 5, while varying these other model parameters. Concluding that this program passes a benefit-cost test is robust to a wide range of assumed values of model parameters. We present calculations only for the central estimate of the discount rate ($r$=2.38%) and our assumed value of 25% of the target population having potential to become sex traders ($\gamma$=0.25).[50] Part A of Table 6 assumes program effectiveness at 70%, our central assumption, while Part B presents the same *NPV* comparisons with program effectiveness lowered to 50%. The lowest

**Table 5** Model results: net present value in $ per client.

| Discount rate | Effectiveness parameter | | | | | |
|---|---|---|---|---|---|---|
| | $\alpha$=1 | $\alpha$=0.90 | $\alpha$=0.70 | $\alpha$=0.50 | $\alpha$=0.30 | $\alpha$=0.10 |
| Part A: Minnesota portion of shelter cost included | | | | | | |
| 1.38% | 90,342 | 81,083 | 62,565 | 44,047 | 25,530 | 7012 |
| **2.38%** | 82,566 | 74,084 | **57,122** | 40,159 | 23,197 | 6234 |
| 3.38% | 75,888 | 68,074 | 52,447 | 36,820 | 21,193 | 5566 |
| 5.0% | 66,921 | 60,005 | 46,171 | 32,337 | 18,504 | 4670 |
| 7.0% | 58,163 | 52,122 | 40,040 | 27,958 | 15,876 | 3794 |
| Part B: All shelter cost excluded | | | | | | |
| 1.38% | 91,744 | 82,485 | 63,967 | 45,449 | 26,932 | 8414 |
| **2.38%** | 83,968 | 75,486 | **58,524** | 41,561 | 24,599 | 7636 |
| 3.38% | 77,290 | 69,476 | 53,849 | 38,222 | 22,595 | 6968 |
| 5.0% | 68,323 | 61,407 | 47,573 | 33,739 | 19,906 | 6072 |
| 7.0% | 59,565 | 53,524 | 41,442 | 29,360 | 17,278 | 5196 |

Assumes: 90% filtering efficiency and $\gamma$=0.25, so $\theta$=0.77.
Assumes: demand elasticity at −2 and supply elasticity at 0.5, so $\rho$=0.801.
Central estimate in bold.

**50** Rationale for this explained on page 18.

https://doi.org/10.1515/jbca-2013-0021 Published online by Cambridge University Press

**Table 6** Sensitivity analysis of *NPV* per client.

| Filtering efficiency | | Elasticities and non-replacement parameter | | | |
|---|---|---|---|---|---|
| | $E_D$ | −2 | −2 | −1 | −0.5 |
| | $E_S$ | 0.2 | 0.5 | 0.5 | 1 |
| | $\theta/\rho$ | 0.910 | 0.801 | 0.668 | 0.334 |
| Part A: $\alpha$=***0.7*** | | | | | |
| $\beta$=1.0 | 1 | 85,348 | 74,855 | 62,053 | 29,903 |
| ***β*=0.9** | **0.77** | 65,201 | **57,122** | 47,264 | 22,509 |
| $\beta$=0.7 | 0.53 | 44,178 | 38,617 | 31,832 | 14,793 |
| $\beta$=0.5 | 0.4 | 32,791 | 28,594 | 23,473 | 10,613 |
| $\beta$=0.3 | 0.32 | 25,783 | 22,426 | 18,329 | 8041 |
| $\beta$=0.1 | 0.27 | 21,404 | 18,571 | 15,114 | 6434 |
| Part B: $\alpha$=*0.5* | | | | | |
| $\beta$=1.0 | 1 | 60,321 | 52,826 | 43,682 | 20,717 |
| $\beta$=0.9 | 0.77 | 45,930 | 40,159 | 33,118 | 15,436 |
| $\beta$=0.7 | 0.53 | 30,914 | 26,942 | 22,095 | 9924 |
| $\beta$=0.5 | 0.4 | 22,780 | 19,782 | 16,124 | 6939 |
| $\beta$=0.3 | 0.32 | 17,775 | 15,376 | 12,450 | 5102 |
| $\beta$=0.1 | 0.27 | 14,646 | 12,623 | 10,154 | 3953 |

Includes shelter cost, $r$=2.38% and $\gamma$=0.25.
Central estimate in bold.

figure here (bottom right) still shows a positive *NPV* per client with the most pessimistic assumption for filtering efficiency (10%) and market conditions with the lowest non-replacement (0.334). Under these pessimistic assumptions the *NPV* remains positive until program effectiveness falls below 18% (i.e. $\alpha$<0.18).

# 6 Conclusions

Public concerns over sex trading and sex trafficking have emerged in recent years as a policy priority across the US and indeed in many other countries. We provide a framework for benefit-cost analysis to evaluate intervention programs that seek to prevent sex trading and trafficking of youth. Benefits are understood as harms avoided by successful intervention that prevents adolescents from trading sex, while costs are predominantly public expenditures required for intervention. Based on considerations of standing, we conclude that impacts on buyers in the market where sex is traded and market facilitators (pimps and traffickers) should be excluded from any social welfare review. The pattern of harms precipitated by

https://doi.org/10.1515/jbca-2013-0021 Published online by Cambridge University Press

sex trading, and thus benefits returned by an intervention program, depend on complicated and subtle features of behaviors in these markets.

Our model is based on a representative individual who would become engaged in sex trading across a specified trajectory of sex trading behavior that crucially affects the extent and nature of harms. We integrate three broad determinants of policy success: intervention program effectiveness in dissuading clients from entering (or continuing) sex trading, capability of program screeners to filter out potential clients who actually have no sex trading potential, and dynamics of the sex market that lead to replacement of individuals successfully prevented from trading sex. We considered several distinct harms of trading sex with respect to the private and public nature of the damages that they impose. While the major components of intervention cost can be tied to public expenditure, significant parts of the harms from sex trading are private costs. Thus a large part of the social benefits that would flow from reduced sex trading (i.e. avoided harms) are private rather than public.

We illustrate our framework with a case study drawn from the experience of Minnesota. To make computation of avoided harms tractable within a distinct boundary, we limit the scope of benefits and costs to impacts on state and local budgets. That is, we restrict the scope of the applied model to public benefits and costs alone. The benefit side of this effort is particularly challenging. We conservatively identify and evaluate 17 specific harms, relying on prior research on behaviors and outcomes in sex markets that provide empirical evidence on the quantity and value of these harms. On the cost side we rely on evidence from the accounts of an existing intervention program currently operating in Minnesota, complemented with estimates of required shelter cost based on public budgets.

Table 5 summarizes our calculations as the Net Present Value per client served, along with sensitivity analysis pertaining to two main model parameters. Table 6 presents further sensitivity analysis with respect to other model parameters. In all cases presented in these tables, Net Present Value per client is positive. Only by driving parameter values to extremely pessimistic levels does Net Present Value become negative. We do not believe values like this are reasonable approximations to reality, so we conclude that taxpayers in Minnesota would receive net gains if such a program were implemented.

Given that our work in estimating the value of harms avoided took pains to understate their quantity and unit cost when judgment was required, and given that we have excluded several types of harm associated with sex trading, we believe that the evidence we have compiled argues strongly that pursuit of social policy of this nature is in the best interest of Minnesota citizens even from the narrow perspective of public budgets. If a broader conception of benefit and cost were the basis of economic analysis, the recommendation would only be stronger.

https://doi.org/10.1515/jbca-2013-0021 Published online by Cambridge University Press

The preliminary calculation presented in Section 4 for the value of avoided homicide risk shows benefits would be increased by 47% by including this harm alone. This general conclusion, that investment in human capital for behavioral purposes has significant social returns, is in line with conclusions reached by James Heckman and his colleagues in a series of papers related to investment at even earlier ages (Heckman, 2006). The robustness of our findings suggest that net gains from youth intervention to prevent sex trading are likely to prevail in other settings, but that will depend on empirical specifics. Our framework can easily be adapted to produce additional case studies.

The most important work ahead, in our view, is to improve the empirical foundation of our analysis. This includes refined evaluations of all the harms, but work is especially needed with respect to mental health issues and how lifetime earnings potentials are affected by a period of engaging in sex trading. Longitudinal surveys of sex trading behavior are needed to provide more accurate characterization of trajectories and of harms experienced. Assessment of harms tied to infectious disease is a particularly important aspect that needs further work. First, we include only two STIs, but others are relevant. Second, we tie this harm only to the sex traders themselves, but effects on clients[51] and on the wider community should also be brought under review.

The dynamics of market adjustment are only crudely represented in our framework through the non-replacement coefficient. But interesting questions arise regarding details of this adjustment: Do buyers shift from purchasing sex with juveniles to purchasing sex from adults? Is replacement primarily by incumbents working longer hours or by new entrants? Are new entrants independent traders or primarily facilitated by traffickers? Are new entrants likely to have different trajectories compared to those who were dissuaded? Does market adjustment involve shifts in structure toward more or less market concentration? Answers to these questions require substantially more empirical research on sex markets. The findings could lead to refinements in our empirical results, but we believe the essential framework we propose can adequately embrace new findings from such research.

**Acknowledgments:** The Nathan Cummings Foundation provided financial support for this research through the Minnesota Indian Women's Resource Center (MIWRC). The authors are grateful for that support and wish to thank several individuals for contributions to this paper. Suzanne Koepplinger, Executive Director of MIWRC, was a sounding board and supporter of this project from

51 Although we argue in Section 2 that clients lack standing, to the extent that they would access publically financed medical treatment this harm is still relevant for benefit calculation.

the beginning. Lauren Stark and Jon Luke Robertson provided research assistance. Many individuals helped us identify harms and uncover critical cost data for the Minnesota case study. These include: Julie Rud, Kathryn Ritchman, Laurel Edinburgh, Elizabeth Saewyc, Beth Holger-Ambrose, Sarah Gordon, Candy Hadsall, Artika Roller, and Nancy Dunlap. Debra Israel, Mark Cohen and Alexandra (Sandi) Pierce provided commentary on early drafts and made useful suggestions to extend the analysis in particular directions. Robert Guell provided expert advice on some computational issues, DeVere Woods advised us on criminal justice aspects, and Larry Gant checked our treatment of HIV/AIDS issues and guided us to the most recent empirical literature on costs and survival. Sam Lee provided an elegant solution to a particular analytical puzzle. We also benefited from comments by student and faculty participants in Indiana State University's Social Science Research Colloquium and the Brown Bag Seminar series of ISU's Department of Criminology and Criminal Justice. Through careful reading and commentary the editor and reviewers for the *Journal of Benefit Cost Analysis* provided very useful critical advice. Any errors remain the responsibility of the authors.

## Appendix A: Analysis[52] to derive non-replacement coefficient, $\rho$

The non-replacement coefficient represents the proportion of dissuaded sex traders (potential or actual) who are *not replaced* by new market entrants in response to an increase in earnings. This appendix explains the calculation of coefficient values in Table 2. To follow the derivation intuitively, readers could refer to Figure 1 in the text, which shows a stable demand curve (D) and two equilibria that result from an original supply curve ($S_1$ with equilibrium $e_1$) and a supply curve shifted leftward ($S_2$ with equilibrium $e_2$).

We use iso-elastic demand and supply relations with the following specifications. Demand: $W=bL^{\frac{1}{\eta}}$; Supply: $W=kL^{\frac{1}{\varepsilon}}$; where $\eta$=price elasticity of demand (<0) and $\varepsilon$=price elasticity of supply (>0). To model the intervention program's effect on supply, the $k$ parameter is increased, shifting supply to the left. Equilibrium values of $L$ and $W$ are found as follows.

52 We are indebted to Samuel Lee for solving this analytical puzzle.

https://doi.org/10.1515/jbca-2013-0021 Published online by Cambridge University Press

$$bL^{\frac{1}{\eta}}=kL^{\frac{1}{\varepsilon}}\Leftrightarrow L^{\frac{\varepsilon-\eta}{\varepsilon\eta}}=\frac{k}{b}\quad\text{so that}\quad L^{*}=\left(\frac{k}{b}\right)^{\frac{\varepsilon\eta}{\varepsilon-\eta}}$$

Use this in the supply relation to find $W^{*}$: $W^{*}=k\left[\left(\frac{k}{b}\right)^{\frac{\varepsilon\eta}{\varepsilon-\eta}}\right]^{\frac{1}{\varepsilon}}=k\left(\frac{k}{b}\right)^{\frac{\eta}{\varepsilon-\eta}}$

Consider two values of $k$, $k_1$ for status quo, and $k_2$ reflecting the impact of the intervention program on the supply of sex traders. Accordingly, we define the following equilibrium values:

$$L_1^{*}=\left(\frac{k_1}{b}\right)^{\frac{\varepsilon\eta}{\varepsilon-\eta}}\qquad W_1^{*}=k_1\left(\frac{k_1}{b}\right)^{\frac{\eta}{\varepsilon-\eta}}\qquad\text{and}\qquad L_2^{*}=\left(\frac{k_2}{b}\right)^{\frac{\varepsilon\eta}{\varepsilon-\eta}}$$

Define $\hat{L}$ as the number of sex traders under parameter $k_2$ but at earnings, $W_1^{*}$. Using the equilibrium wage expression with the supply relation, we can solve for $\hat{L}$ as a function of market parameters.

$$W_1^{*}=k_1\left(\frac{k_1}{b}\right)^{\frac{\eta}{\varepsilon-\eta}}=k_2\hat{L}^{\frac{1}{\varepsilon}}\Leftrightarrow\hat{L}=\left(\frac{k_1}{k_2}\right)^{\varepsilon}\left(\frac{k_1}{b}\right)^{\frac{\varepsilon\eta}{\varepsilon-\eta}}=\left(\frac{k_1}{k_2}\right)^{\varepsilon}L_1^{*}$$

The non-replacement coefficient is defined as: $\rho=\frac{L_1^{*}-L_2^{*}}{L_1^{*}-\hat{L}}$ (A1)

Substitute for $\hat{L}$, factor out $L_1^{*}$ and substitute for $L_1^{*}$ and $L_2^{*}$ to find:

$$\rho=\frac{L_1^{*}-L_2^{*}}{L_1^{*}\left[1-\left(\frac{k_1}{k_2}\right)^{\varepsilon}\right]}=\frac{1-\frac{L_2^{*}}{L_1^{*}}}{1-\left(\frac{k_1}{k_2}\right)^{\varepsilon}}=\frac{1-\left(\frac{k_2}{b}\right)^{\frac{\varepsilon\eta}{\varepsilon-\eta}}\left(\frac{b}{k_1}\right)^{\frac{\varepsilon\eta}{\varepsilon-\eta}}}{1-\left(\frac{k_1}{k_2}\right)^{\varepsilon}}=\frac{1-\left(\frac{k_2}{k_1}\right)^{\frac{\varepsilon\eta}{\varepsilon-\eta}}}{1-\left(\frac{k_1}{k_2}\right)^{\varepsilon}}$$

Define a supply shift parameter, $\phi$, using $k_2=\phi k_1$ and substitute into the previous expression, which, with simplification, yields

$$\rho=\frac{1-(\phi)^{\frac{\varepsilon\eta}{\varepsilon-\eta}}}{1-(\phi)^{-\varepsilon}}$$ (A2)

https://doi.org/10.1515/jbca-2013-0021 Published online by Cambridge University Press

The shift parameter depends primarily on the extent of leftward shift of supply, but it is also sensitive to the supply elasticity. Since we cannot know precisely how much intervention will shift supply leftward, we investigate calculations of $\rho$ for three different shifts defined as percentages from an arbitrary value of $L_1$: 1%, 10% and 20%. To find the shift parameter, define the percent change in $L$ at a constant wage as: $\%\Delta L=\frac{\hat{L}-L_1}{L_1}=\frac{\hat{L}}{L_1}-1<0$.

Substituting the expression for $\hat{L}$ we have: $\%\Delta L=\left(\frac{k_1}{k_2}\right)^{\varepsilon}-1$, from which we can find the following relationship between $k_2$ and $k_1$: $k_2=k_1(1+\%\Delta L)^{\frac{-1}{\varepsilon}}$. Thus $\phi=(1+\%\Delta L)^{\frac{-1}{\varepsilon}}$ which can be substituted into (A2) to express $\rho$ as a function of the extent of shift and the two price elasticities.

$$\rho=\frac{1-\left[(1+\%\Delta L)^{\frac{-1}{\varepsilon}}\right]^{\frac{\varepsilon\eta}{\varepsilon-\eta}}}{1-\left[(1+\%\Delta L)^{\frac{-1}{\varepsilon}}\right]^{-\varepsilon}}=\frac{1-(1+\%\Delta L)^{\frac{-\eta}{\varepsilon-\eta}}}{-\%\Delta L} \tag{A3}$$

Table A1 shows values of the non-replacement coefficient for three different assumptions for each elasticity and three different supply shifts. Without knowing the size of the market, we cannot know the percentage reduction of sex

**Table A1** Values of $\rho$ under different elasticity assumptions.

| Supply elasticity | Demand elasticity | | |
|---|---|---|---|
| | −0.5 | −1 | −2 |
| 1% Reduction | | | |
| 0.2 | 0.715 | 0.834 | 0.910 |
| 0.5 | 0.501 | 0.668 | 0.801 |
| 1 | 0.334 | 0.501 | 0.668 |
| 10% Reduction | | | |
| 0.2 | 0.725 | 0.841 | 0.913 |
| 0.5 | 0.513 | 0.678 | 0.808 |
| 1 | 0.345 | 0.513 | 0.678 |
| 20% Reduction | | | |
| 0.2 | 0.737 | 0.848 | 0.918 |
| 0.5 | 0.528 | 0.691 | 0.817 |
| 1 | 0.358 | 0.528 | 0.691 |

https://doi.org/10.1515/jbca-2013-0021 Published online by Cambridge University Press

traders that an intervention would cause. Although this parameter is relatively insensitive to the extent of supply shift, it does increase with the shift extent. Thus a more conservative claim for intervention benefits would be based on a smaller supply shift. For the purpose of the case study we assume a 1% shift.

## Appendix B: Comparison of model results with the original application

An earlier version of our framework supported policy discussion in Minnesota. Based on constructive critical remarks from conference participants and reviewers of this journal, we have since refined the model and adjusted its empirical content. The results are presented above in Section 5. Results from the original application of our framework can be found in the report released in 2012, which is available on-line here: http://www.miwrc.org/wp-content/uploads/2013/12/Benefit-Cost-Study-Full.pdf.

This appendix explains specific changes made in refining the model and reviews how those changes affected results of the calculations. In general the refinements had minor impacts, and our overall conclusion remains the same. From the perspective of Minnesota taxpayers, an intervention program like we analyze returns a positive net present value, making it a good public investment. Below we list the individual modifications with brief assessments of how these changes affected results in relation to the original model application.

1. *Inclusion of an additional harm: public cost of homicide investigation*. This increased the present value of benefits by a small amount, about 0.1%.
2. *A more conservative supply shift assumption (1% rather than 10%)*. This affected the non-replacement coefficient (see appendix A), decreasing it from 0.81 to 0.801. This decreased the present value of benefits proportionately, by about 1.1%. Combining this change with the additional harm noted above resulted in a reduction of about 1% in the present value of benefits.
3. *Increase in Minnesota share of shelter cost*. Our original application excluded all the federal contribution to shelter cost, which is considerable. In the revised model we included the portion of that contribution that can be linked to Minnesota taxpayers (3%). The effect was to increase annual shelter cost per client from $903 to $1402. When combined with programming service cost, this change increased overall cost per client by 28%. This decreased all *NPV* calculations where shelter cost is included, but the extent depends on both the rate of discount and the program effectiveness coefficient ($\alpha$).

https://doi.org/10.1515/jbca-2013-0021 Published online by Cambridge University Press

At maximum program effectiveness ($\alpha$=1) the reduction in *NPV* per client is around 0.6%. For very low program effectiveness ($\alpha$=0.1) the reduction of *NPV* is around 8%. These effects are nearly the same for all three discount rates.

4. *Broader sensitivity analysis with respect to the discount rate*. In the original model application we used only three discount rates: the central rate derived from review of Minnesota general obligation bonds and rates higher and lower than this by 1 percentage point. The results presented in Section 5 include *NPV* figures calculated with 5% and 7% rates of discount as well. Given the model structure, higher discount rates will decrease the *NPV*, as can be seen in Tables 4 and 5, but the effects are relatively modest since the time profiles of most benefits is rather short.

## References

Aldy, J. E., & Viscusi, W. K. (2008). Adjusting the value of a statistical life for age and cohort effects. *The Review of Economics and Statistics*, *90*(3), 573–581.

American Law Institute. (1962). *Model penal code*. Philadelphia, Pa.: The Institute.

Brewer, D. D., Dudek, J. A., Potterat, J. J., Muth, S. Q., 4 B. A.; Roberts, J. M., … Woodhouse, D. E. (2006). Extent, trends, and perpetrators of prostitution-related homicide in the United States. *Journal of Forensic Science*, *51*(5), 1101–1108.

Curtis, R., Terry, K., Dank, M., Dombrowski, K., & Khan, B. (2008). *The commercial sexual exploitation of children in New York city: the CSEC population in New York City: size, characteristics, and needs*. (1). New York, New York: Center for Court Innovation.

Dalla, R. L. (2006). "You can't hustle all your life": an exploratory investigation of the exit process among street-level prostituted women. *Psychology of Women Quarterly*, *30*(3), 276–290.

DeRiviere, L. (2006). A human capital methodology for estimating the lifelong personal costs of young women leaving the sex trade. *Feminist Economics*, *12*(3), 367–402.

Edwards, J. M., Iritani, B. J., & Hallfors, D. D. (2006). Prevalence and correlates of exchanging sex for drugs or money among adolescents in the United States. *Sexually Transmitted Infections*, *82*(5), 354–358.

Farley, M. (2004). Bad for the body, bad for the heart: prostitution harms women even if legalized or decriminalized. *Violence Against Women*, *10*, 1087–1125.

Farmer, A., & Horowitz, A. W. (2013). Prostitutes, pimps, and brothels: intermediaries, information and market structure in prostitution markets. *Southern Economic Journal*, *79*(3), 513–528.

Graham, N., & Wish, E. (1994). Drug use among female arrestees: onset, patterns, and relationships to prostitution. *Journal of Drug Issues*, *24*, 315–330.

Greene, J. M., Ennett, S. T., & Ringwalt, C. L. (1999). Prevalence and correlates of survival sex among runaway and homeless youth. *American Journal of Public Health*, *89*(9), 1406–1409.

Heckman, J. (2006). Skill formation and the economics of investing in disadvantaged children. *Science*, *312*(5782), 1900–1902.

https://doi.org/10.1515/jbca-2013-0021 Published online by Cambridge University Press

Kurtz, S. P., Surratt, H. L., Kiley, M. C., & Inciardi, J. A. (2005). Barriers to health and social services for street-based sex workers. *Journal of Health Care for the Poor and Underserved*, *16*(2), 345–361.

Levitt, Steven, & Venkatesh, Sudhir. (2007). An empirical analysis of street-level prostitution. Working paper. Retrieved from http://economics.uchicago.edu/pdf/Prostitution%205.pdf.

Martin, L., Hearst, M., & Widom, R. (2010). Meaningful differences: comparison of adult women who first traded sex as a juvenile versus as an adult. *Journal of Violence Against Women*, *16*(11), 1252–1269.

McClanahan, S. F., McClelland, G. M., Abram, K. M., & Teplin, L. A. (1999). Pathways into prostitution among female jail detainees and their implications for mental health services. *Psychiatric Services*, *50*(12), 1606–1613.

Miller, C. L., Fielden, S. J., Tyndall, M. W., Zhang, R., Gibson, K., & Shannon, K. (2011). Individual and structural vulnerability among female youth who exchange sex for survival. *Journal of Adolescent Health*, *49*(1), 36–41.

Minnesota Department of Health. (2011). *2010 Minnesota sexually transmitted disease statistics*. Retrieved from http://www.health.state.mn.us/divs/idepc/dtopics/stds/stats/stdreport2010.pdf.

Monto, M., & Milrod, C. (2014). Ordinary or Peculiar Men? Comparing the customers of prostitutes with a nationally representative sample of men. *International journal of offender therapy and comparative criminology*, *58*(7), 802–820.

O-Brien, James. (2013). *The age-adjusted value of a statistical life: revealed preference evidence from automobile purchase decisions*. Research paper presented at Annual Meetings of the Midwest Economics Association, Columbus, Ohio.

Paul, B., Linz, D. G., & Shafer, B. J. (2001). Government regulation of 'adult' businesses through zoning and anti-nudity ordinances: debunking the legal myth of negative secondary effects. *Communication Law and Policy*, *6*, 355–392.

Persell, D. (2000). *Sex worker assessment project: a HIV needs assessment of sex workers in the Twin Cities*. Hennepin County Community Health Department, Red Door Clinic. Minneapolis.

Potterat, J. J., Brewer, D. D., Muth, S. Q., Rothenberg, R. B., Woodhouse, D. E., Muth, J. B., … Brody, S. (2004). Mortality in a long-term open cohort of prostitute women. *American Journal of Epidemiology, 159*(8), 778–785.

Potterat, J. J., Woodhouse, D. E., Muth, J. B., & Muth, S. Q. (1990). Estimating the prevalence and career longevity of prostitute women. *The Journal of Sex Research*, *27*(2), 233–243.

Saewyc, E. (2011). *Ramsey county runaway intervention project*, Annual Progress Report: 2010.

Saewyc, E. M., & Edinburgh, L. D. (2010). Restoring healthy developmental trajectories for sexually exploited young runaway girls: fostering protective factors and reducing risk behaviors. *Journal of Adolescent Health*, *46*(2), 180–188.

Saewyc, E., MacKay, L., Anderson, J., & Drozda, C. (2008). *It's not what you think: sexually exploitated youth in British Columbia* (pp. 1–63). Vancouver, BC: University of British Columbia School of Nursing.

Saewyc, E. M., Taylor, D., Homma, Y., & Ogilvie, G. (2008). Trends in sexual health and risk behaviours among adolescent students in British Columbia. [Article]. *Canadian Journal of Human Sexuality*, *17*(1/2), 1–14.

Schackman, B., Gebo, K., Walensky, R., Losina, E., Muccio, T., Sax, P., … Freedberg, K. (2006). The lifetime cost of current human immunodeficiency virus cared in the United States. *Medical Care*, *44*(11), 990–997.

https://doi.org/10.1515/jbca-2013-0021 Published online by Cambridge University Press

Sloan, C. E., Champenois, K., Choisy, P., Losina, E., Walensky, R. P., Schackman, B. R., … Yazdanpanah, Y. (2012). Newer drugs and earlier treatment: impact on lifetime cost of care for HIV-infected adults. *AIDS*, *26*(1), 45–56.

Sugden, R., & Williams, A. (1978). *The principles of practical cost-benefit analysis*. Oxford: Oxford University Press.

Surratt, H. L., Inciardi, J. A., Kurtz, S. P., & Kiley, M. C. (2004). Sex work and drug use in a subculture of violence. *Crime and Delinquency*, *50*(1), 43–59.

Tyler, K. (2009). Risk factors for trading sex among homeless young adults. *Archives of Sexual Behavior*, *38*(2), 290–297.

U.S. Department of State. (2013). *Trafficking in Persons*. Washington: U.S. Department of State. Retrieved from http://www.state.gov/documents/organization/210742.pdf.

Vanwesenbeeck, I. (2001). Another decade of social scientific work on prostitution. *Annual Review of Sex Research*, *12*, 242–289.

Weitzer, R. (2009). Sociology of sex work. *Annual Review of Sociology*, *35*(1), 213–234.

Willis, B. M., & Levy, B. S. (2002). Child prostitution: global health burden, research needs, and interventions. *Lancet*, *359*(9315), 1417–1422.

Wilson, H. W., & Widom, C. S. (2010). The role of youth problem behaviors in the path from child abuse and neglect to prostitution: a prospective examination. *Journal of Research on Adolescence*, *20*(1), 210–236.

Zelizer, V. A. (2005). *The purchase of intimacy.* Princeton: Princeton University Press.

Zerbe, R. O., & Bellas, A. S. (2006). *A primer for benefit-cost analysis*. Cheltenham, UK; Northampton, MA: Edward Elgar.

https://doi.org/10.1515/jbca-2013-0021 Published online by Cambridge University Press