Regulating Prostitution: Theory and Evidence from Italy∗

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Abstract

We set up an equilibrium model of prostitution where potential clients and sex workers simultaneously choose whether to demand and supply sex under 3 different legal regimes: prohibition, regulation and lasseiz-faire. We then calibrate the model to match some key facts about the prostitution market in Italy and we compare the effect of alternative policies on the total quantity of prostitution exchanged in equilibrium and on the harm associated to it. The main findings are the following: i) A prohibition regime under which it is illegal to purchase sex but not to sell it, is better than a prohibition regime where the sex workers bear most of the sanctions. ii) Public health policies that reduce the risk of contracting STD in the prostitution market increase the total quantity of sex exchanged in equilibrium and, for a small reduction of the infection probability, also the harm. However an asymmetric prevention policies that reduce the risk of contagion only for the sex workers actually reduce harm and the cost in terms of increased total quantity is small. iii) While regulation is the best legal regime if the social goal is to minimize harm, prohibition is best if the goal is to minimize the quantity of sex exchanged.

JEL: L51, I18, O17, H21

Keywords: Prostitution, Regulation, Prohibition, Lasseiz-faire.

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1 Introduction

Although there are many strategies to deal with prostitution, they all fall under one of three possible alternatives: prohibition (criminalization), regulation (legalization) and laissez-faire. Prohibition involves the use of sanctions to control prostitution. Under regulation, attempts are made to license or register sex workers. Under laissez-faire prostitution is regarded neither as a crime nor as a licensable activity and the Government avoids any intervention.

The goal of this paper is to set up an equilibrium model of prostitution where potential clients and sex workers simultaneously choose whether to demand and supply sex under these three different legal regimes. We calibrate the model to match some key facts from Italy to then perform a quantitative analysis exercise to compare alternative policies in terms of the total quantity of prostitution exchanged in equilibrium and of the harm associated to it.

We consider different social goals because, for an activity as questionable as prostitution, there exist very different attitudes. Specifically, those who believe that prostitution is simply morally wrong would elect total quantity minimization as their goal. On the other hand, those who consider prostitution as a simple exchange transaction would only want to minimize the side effects of this trade, choosing total harm as their policy objective. We do not take a stand. We simply provide a quantitative assessment of the effects of alternative policies to inform the policy debate.

Under prohibition, the prostitution services are exchanged in an illegal market and the law is enforced through sanctions for clients and/or sex workers. Under regulation, there exists a legal market for prostitution where the sex workers pay taxes. But this legal market will tend to coexist with an illegal one, since both sex workers and customers will try to dodge taxes. Therefore, enforcement is still needed. In addition, the government can also perform health policies targeted to the legal market, which, by definition, it is the only one that it can control. The aim of these policies is to reduce the transmission of Sexually Transmittable Diseases (STD) both for customers and sex workers. Finally, under a laissez-faire regime, prostitution services are exchanged in a legal and unregulated market.

In the model, potential clients differ in the benefit they receive from consuming mercenary sex and in the value of their lifetime earnings, which they put at stake with risk of contracting
potential life-threatening diseases. They decide whether to buy one unit of sex from the legal or the illegal market, assuming this distinction does exists. Potential sex workers differ in the lifetime earning opportunities from alternative occupations. They choose whether to supply prostitution and, depending on the legal regime, between the legal and the illegal market.

The model is then calibrated to actual data on the prostitution market in Italy, whose legislation arguably configures a laissez-faire regime. We then use this benchmark model to evaluate the effects of alternative policies on the total quantity of prostitution exchanged in equilibrium and on the harm associated to it.

The prohibition regime is compared to the laissez-faire by setting taxes and prevention to zero. For a given level of the sanction, we find that an increase in enforcement decreases both quantity and harm. In a second exercise we keep enforcement constant and we look at the effect of different sanctions. The goal is to compare to opposite approaches to prohibition: the first, which is practiced by Sweden, makes it illegal to purchase sex but not to sell it. The second, of which the US is the most notable example, is characterized by a low rate of enforcement toward purchasers, so that, de facto, the sex workers are the only ones who bear the burden of the sanctions. We show that the Swedish approach is much more effective than the American approach at reducing quantity.

We then compare a regulation regime with a laissez-faire regime. There are three important elements of a regulation regime: the existence of a legal market for prostitution where sex workers pay taxes. The enforcement against the illegal market, which will typically tend to coexist with the legal. The possibility of implementing health policies targeted to the legal market. The effect of an increase in taxes or in enforcement is a decreased total quantity and harm. Health policies, by reducing the risk associated to the legal market, substantially increase total quantity. Moreover, while a decreased health risk is associated to a smaller harm for each legal transactions and to a smaller number of illegal transactions, it is also associated to a bigger number of legal transactions. For a small reduction of the infection probability the latter effect prevails and harm is increasing in prevention. However, we also show that this backfiring effect can be avoided through an asymmetric prevention policy that decreases only the probability of contagion of the sex workers.

In the last exercise we compare the regulation and prohibition regimes. We find that,
while regulation is preferable if the social goal is to minimize harm, prohibition is more effective at decreasing the total quantity.

Our work is closely related to Becker et al. (2006). They consider the cost of reducing consumption of a good by making its production illegal and punishing apprehended illegal producers. They compare the effectiveness of this prohibition approach with a tax on legal production that punishes only producers who try to avoid the tax through illegal production. They show that the monetary tax on a legal good could cause a greater reduction in output and increase in price than optimal enforcement against production when the good is illegal. We extend their analysis by explicitly modeling the choice, for clients and sex workers, between legal and illegal markets. We also show, in our quantitative exercise, that legalizing prostitution and taxing it can reduce the total quantity of prostitution exchanged in equilibrium with respect to a \textit{laissez-faire} regime but not with respect to a prohibition regime. However, legalizing prostitution can be more effective than prohibition in alleviating the harm associated with prostitution.

Other recent theoretical and empirical papers investigated the determinants of prices, demand and supply of prostitution. For Edlund and Korn (2002) prostitution is a low-skilled, labor intensive, female and well paid occupation. They argue that an important opportunity cost associated to prostitution is the forgone marriage opportunities and that this cost explains the high wages. Cameron (2002) provides a more complex explanation for the high wages in terms of compensation for social exclusion, risk, boredom and physical effort, distaste and loss of recreational sex pleasure. Rao et al. (2003) and Gertler et al. (2005) use microdata to quantify the risk compensation required by the sex workers for not using the condom. They argue that the prostitutes accept the extra risk substantially because the customers are willing to pay them well to do it. Moffatt and Peters (2004) identify the factors affecting price in a regression framework for a sub-sector of the prostitution market in the United Kingdom and they provide estimates of the earnings, both at the aggregate and at the individual level. Cameron and Collins (2003) focus on the demand side, and use UK microdata to identify the characteristics of the male customers that influence their demand for prostitution. Della Giusta et al. (2009) propose a very similar study. Cameron et al. (1999) use principal component and regression analysis on data drawn from advertisements
The remainder of the paper is organized as follows. In section 2 we provide background information on the Italian legislation on prostitution. In section 3 we set up the theoretical model. In section 4 we describe the calibration of the model to actual Italian data. In section 5 we describe all the policy exercises. We offer some concluding remarks in section 6.

2 Italian Prostitution Law

Prior to 1958, prostitution in Italy was legal and strictly regulated by a 1931 law enacted by the king Vittorio Emanuele III. Among other provisions, the law was very specific in the discipline of brothels, but the main concern of the legislator was public order, moral and decor and little attention, if any, was dedicated to the prostitutes and their condition. To give an idea, it was forbidden to locate a brothel close to a school, a church or even to a public market and it was forbidden to open the windows even at night (which is the reason why the brothels were typically called ”Closed Houses”). But the only protection granted to the prostitutes was the freedom to quit the job at will, which rarely happened, given the social stigma associated to prostitution and thus the substantial lack of alternatives for these women, both in terms of work and marriage.\footnote{On this see Edlund and Korn (2002).} The main problem is that it was legal, for a brothel owner, to hire prostitutes and to cash part of the proceedings from their activities and thus to exploit them economically. Combined with the absence of any outside option for the women, the result was that many of them were forced into a condition akin to slavery.

In an attempt to better protect the prostitutes and to improve their condition, Lina Merlin, an Italian senator, started a political campaign which culminated with the enactment of the so-called Merlin Law in 1958. Under this new law, which is still effective, it is illegal for any individual other than the prostitute to take economic advantage from prostitution, for instance through intermediation, solicitation, etc. But prostitution itself, the exchange of sex for money, is not illegal. The brothels, which hired prostitutes as workers or asked for percentages on their earnings, were declared illegal and they were all closed soon after
the law was enacted. In addition, the law specifically states that it is illegal for all public offices to keep records of the prostitutes. This last statement implies that the income from prostitution cannot be taxed, coherently with the spirit of a law that does not allow anybody to profit from prostitution, not even the government.

However, a sentence pronounced by the Italian highest court in October 2010, which, under current Italian laws, de facto imposes the same sentence on similar trials, interpreted the law differently. It ruled that ”Even if prostitution is questionable from a moral standpoint, it is not an illicit activity” and thus ”There is little doubt that it should be taxed.” This clearly opens to the possibility of prosecuting prostitutes for fiscal evasion. But it is too early to judge the impact of this sentence on the prostitution market. Also because, as some legal scholar observed, since this sentence appears to be contrast with one of the main provisions of the Merlin Law, it is not unlikely that the same court will overrule the sentence in the near future.

In 2008, two members of the Italian Government, Carfagna and Maroni, proposed a partial reform of the current system. They proposed a distinction between prostitution in public places, which will be considered illegal, and prostitution in closed places, which will not. The provisions of the Merlin Law will remain effective for the prostitution in closed places. But both the street prostitutes and their customers can be prosecuted just for exchanging sex for money and they can face a jail sentence of up to two years. It will still be a crime to take economic advantage from both the legal and the illegal prostitution and the punishment will be substantially more severe with respect to the Merlin Law. The declared intent of this new proposal is to reduce the number of active prostitutes in the market and prevent them from being enslaved. The possibility of arresting the customers and the increased jail sentences go clearly in this direction. What is perhaps less clear is why the arrest of the prostitutes should help protecting them and, more importantly, why the law does not acknowledge the possibility of exploitation in apartments\textsuperscript{2}. After all, this is exactly what Merlin fought against.

This proposal, that would de facto introduce a prohibition regime, has not been ratified

\textsuperscript{2}In fact many charitable organizations that help prostitutes agree that the typical strategy used by the individuals that enslave prostitutes entails confining them to apartments to prevent any contact both with other women and with the volunteers of the organizations.
yet by the parliament, in part because of this simple considerations that we proposed. For the

time being, prostitution is therefore legal and no attempts have been done by the Government
to affect prostitution through topical policies like taxes and preventive activities. The point

is that a true quantitative assessment of the impact of alternative policies is missing and the
debate has been mostly grounded on moral arguments. We do not want to claim that such
considerations are not important. But we think that, without considering all the possible
consequences of a policy on the prostitution market, it is impossible to state any serious
judgment. With this work we try to fill this gap.

3 The Model

We consider two continuum of agents: one of potential clients and one of potential sex
workers who simultaneously decide whether to demand and supply sex. More specifically,
potential clients decide whether to buy one unit of sex or not and if they do buy sex they
also choose between a legal and an illegal market, if such a distinction does exists. Potential
sex workers, decide to abstain from prostitution or to sell one unit of sex. If they do sell sex,
they also choose between legal and illegal markets. In the theoretical model we consider a
single standardized sex transaction, ignoring the different type of services exchanged in the
market.

We denote a policy by $\varphi_m=(F_c,F_{sw},t,f,p)$ with $m=P,R,LF$. Under regulation ($R$),
the government creates a legal market for prostitution, requiring the sex workers to pay taxes
$t$. However, since the illegal market will tend to coexist with the legal, the government still
needs to do enforcement. More specifically, clients and sex workers meeting in the illegal
market will be discovered with probability $f$ and sanctioned $F_c$ and $F_{sw}$, respectively. In
addition, the government can also perform health policies $p$ targeted to the legal market,
which is easier to control with ad-hoc regulation. The goal is to reduce the transmission
of Sexually Transmittable Diseases (STD), the main health risk for both customers and sex
workers. In this case a policy $\varphi_R=(F_c,F_{sw},t,f,p)$ will also include, together with sanctions
and enforcement (which are only levied in the illegal market), taxes and preventive activities
for the sex workers in the legal market. Under prohibition ($P$), the prostitution services are
exchanged in an illegal market, and the government enforces the law through sanctions for clients and sex workers. In this case a policy \( \varphi_p = (F^c, F^{sw}, f) \) prescribes the size of the sanctions and the enforcement. Finally under *laissez-faire* (LF), prostitution services are exchanged in a legal and unregulated market and the Government does not play any role. In this latter case no policy is implemented, i.e. \( \varphi_{LF} = (0, 0, 0, 0) \).

**Regulation**

Under regulation the utility of a sex worker that participates to the legal market is the following:

\[
U_{R}^j = \left(1 - \sum_{j=1}^{J} \pi_{j}^{sw}(p)\right) v(q'(1 - t) + hu) + \sum_{j=1}^{J} \pi_{j}^{sw}(p)v(q'(1 - t) + hu(1 - \alpha_j))
\]

where \( q' \) is the price paid for the prostitution service, \( t \) is the tax rate and \( v(.) \) is a concave utility function with \( v'(.) > 0 \) and \( v''(.) < 0 \). We model the risk of being a sex worker as the probability of getting an STD, which would result in the loss of part of the lifetime income \( hu \), where \( h \) is a scale parameter that we will need in the numerical implementation of the model. \( \pi_{j}^{sw}(p) \) is the probability that the sex worker contracts one of the \( J \) possible STD, resulting in the loss of a fraction \( \alpha_j \leq 1 \) of the lifetime income. Since we allow for the presence of preventive policies \( p \) implemented by the government and targeted to the legal market, this probability depends on them. We have a measure 1 of potential sex workers who differ in their lifetime income \( u \). We assume that \( u \) follows a triangular distribution in \([0, \bar{u}]\) with peak at 0. The pdf of this distribution is the following:

\[
f_u(y) = \frac{2(\bar{u} - y)}{\bar{u}^2} \quad 0 \leq y \leq \bar{u}.
\]

Basically the probability mass is linearly decreasing at the rate \( 2/(\bar{u}^2) \) over the entire support, from \( 2/\bar{u} \) (associated to 0) to 0 (associated to \( \bar{u} \)). In practice, even if we model prostitution as a voluntary choice we acknowledge that, for a large number of sex workers, the choice is mostly dictated by the absence of valuable outside opportunities. Some of this individuals without outside opportunities are the ones coerced into prostitution with little
hope to escape. For those sex workers that actually have valuable outside opportunities, in the upper portion of the distribution of $u$, our assumption captures also the skewed distribution of skills in the general population. We chose a linearly decreasing probability and a bounded support for $u$ because the resulting distribution is fully described by a single parameter, a feature that reduces the dimensionality of the calibration problem.

The utility of a sex worker that participates to the illegal market is the following:

$$U^i_R = \left(1 - \sum_{j=1}^{J} \pi^{sw}_j\right) \left[(1 - f)v(q^i + hu) + f v(q^i + hu(1 - F^{sw}))\right]$$

$$+ \sum_{j=1}^{J} \pi^{sw}_j \left[(1 - f)v(q^i + hu(1 - \alpha_j)) + f v(q^i + hu(1 - \alpha_j - F^{sw}))\right]$$

where $q^i$ is the price of a transaction in the illegal market, $f$ is the probability of being discovered by the authorities and $F^{sw}$ the sanction, modeled as a proportion of the lifetime income. Since there are no prevention policies targeted to the illegal market, the STD transmission probability is $\pi^{sw}_j \geq \pi^{sw}_j(p)$.

Potential sex workers that do not engage in prostitution simply have utility $U^0 = v(hu)$.

The utility of a client of a legal sex worker is the following:

$$V^t = \left(1 - \sum_{j=1}^{J} \pi^c_j(p)\right) v(k - q^i + \omega) + \sum_{j=1}^{J} \pi^c_j(p) v(k - q^i + \omega(1 - \alpha_j))$$

where $\pi^c_j(p)$ is the client’s probability of being infected with the STD $j$ for given the actually implemented prevention policies and $\alpha_j$ is the resulting loss, which we assume for simplicity to be equal to the loss suffered by the sex workers. Potential clients differ both in the utility they derive from purchasing prostitution services, $k$ and in the value of lifetime income, $\omega$. We assume that the taste parameter $k$ is uniformly distributed in the interval $[0, \bar{k}]$. Conversely, we assume that $\omega$ follows a triangular distribution in the interval $[0, \bar{\omega}]$ with peak at 0. With this assumption we capture the very skewed nature of the actual distribution.

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3Here we are disregarding any kind of externality that prostitution could cause to people who do not participate in the market. Moreover, we are also implicitly assuming that the funding of public policies has a negligible effect on utilities. Not considering that in our model revenue from taxation could be used to finance other policies creates a bias against regulation.
of income in the population in a way which is, again, tractable and parsimonious. To allow for
different equilibrium shares of customers and prostitutes, we assume that there is a measure
1 + \( x \) of customers, with a positive (negative) \( x \) if the share of customers is bigger (smaller)
than the share of prostitutes. The function that gives us the mass of individuals associated
to intervals in the domain of \( \omega \) is

\[
f_\omega(y) = \frac{2(\bar{\omega} - y)}{\bar{u} \bar{\omega}} \quad 0 \leq y \leq \bar{\omega}.
\]

In what follows, we will sometimes refer to this function as the probability density function
of \( \omega \), but it must be clear that it is not properly a pdf and, therefore, does not have the typical
properties.

Sex workers’ clients in the illegal market have the following utility:

\[
V^i_R = \left(1 - \sum_{j=1}^{J} \pi^c_j \right) \left[(1 - f) v(k - q^i + \omega) + f v(k - q^i + \omega(1 - F^c)) \right]
+ \sum_{j=1}^{J} \pi^c_j \left[(1 - f) v(k - q^i + \omega(1 - \alpha_j)) + f v(k - q^i + \omega(1 - \alpha_j - F^c)) \right]
\]

where \( f \) is the probability of being caught by the authorities, which we naturally assume to
be equal to the probability for the sex workers and \( F^c \) the resulting fine. Potential clients
that don’t buy prostitution services simply have utility \( V^0 = v(\omega) \).

Notice that sex workers have a cost and two advantages of supplying prostitution in the
legal market. The cost is the tax \( t \) levied by the Government on their earning \( q^l \). The
advantages are the lower health risk determined by the prevention policies and the absence
of the enforcement risk due to the legality of the activity. A potential sex worker decides
to supply prostitution services in the legal market if the expected utility is bigger than the
expected utility of supplying prostitution in the illegal market and bigger than the outside
option, i.e. if \( U^l_R \geq U^l_R \) and \( U^l_R > U^0 \). Similarly, a potential sex worker supplies in the illegal
market if \( U^i_R > U^l_R \) and \( U^l_R > U^0 \). While all other potential sex workers will not supply.
The structure of the model for the clients is very similar. However, notice two important differences. They do not bear the cost of the tax $t$ and the determination of the demand is further complicated by the presence of the heterogeneity in tastes $k$. Moreover, since clients have only advantages from the existence of a legal market for prostitution, if they decide to pay for mercenary sex they would opt for the illegal market only if the equilibrium price is sufficiently lower than the price prevailing in the legal market.

**Laissez-faire and Prohibition**

The *laissez-faire* regime consists of a unique legal and unregulated market for prostitution services in which the Government does not play any active role. It can be considered as a special case of a regulation regime in which fines, taxes, enforcement and prevention are all set to zero. In this case the utility of a sex worker that participates to the market is

$$U_L^l = \left(1 - \sum_{j=1}^{J} \pi_{j}^{sw}\right)v(q^l + hu) + \sum_{j=1}^{J} \pi_{j}^{sw}v(q^l + hu(1 - \alpha_j)),$$

while the utility of a client is

$$V_L^l = \left(1 - \sum_{j=1}^{J} \pi_{j}^{c}\right)v(k - q^l + \omega) + \sum_{j=1}^{J} \pi_{j}^{c}v(k - q^l + \omega(1 - \alpha_j)).$$

The utilities of non participating (potential) sex workers and customers are, respectively, $U^0 = v(hu)$ and $V^0 = v(\omega)$.

Finally, the prohibition regime consists of a unique illegal market for prostitution, where the only public intervention is the introduction of sanctions for those who participate in the prostitution market and enforcement of those sanctions. The utilities of customers and sex workers that engage in the market are $V_P^i = V_R^i$ and $U_P^i = U_R^i$.

**Equilibrium**

For any given policy $\phi_m = (F^c, F^{sw}, t, e, p)$, an equilibrium of the model is a couple of prices, $(q_m^l, q_m^i)$ and a couple of quantities $(Q_m^l, Q_m^i)$ such that demand equal supply in both markets, i.e., $D_m^l(q_m^l, q_m^i) = S_R^l(q_m^l, q_m^i)$ and $D_m^i(q_m^l, q_m^i) = S_m^i(q_m^l, q_m^i)$.
The total Harm associated to the market equilibrium is defined as the total mass of individuals that experience some type of health shock:

\[ H_m = \sum_{j=1}^{J} (\pi_{sw}^j(p) + \pi_{c}^j(p))\alpha_j Q_m^l + \sum_{j=1}^{J} (\pi_{sw}^j + \pi_{c}^j)\alpha_j Q_m^i. \]

4 The Italian benchmark

Even if the model is considerably simplified in many respects and regardless of the choice of an analytically convenient distribution for \( u, \omega \) and \( k \) the model still has no analytical solution, even if we assumed risk neutrality. Therefore we resort to a numerical algorithm to compute the solution. In a nutshell, we code a grid search procedure over the couple of legal and illegal prices and we stop when we find the couple that clears both markets. The details of the procedures are quite tedious, since we have to take into account the kinks in both the demand and the supply schedule. A full description of the algorithm is available upon request.

The first step of the numerical analysis is the calibration of the model to actual data on prostitution in Italy. We will then use this benchmark model to evaluate the effects of alternative policies on the total quantity of prostitution exchanged in equilibrium and the harm associated to it.

4.1 Parameters and Calibration

Since prostitution is not illegal in Italy, and since it is also unregulated, we consider the laissez-faire regime as the benchmark and, accordingly, we calibrate the model under this institutional arrangement.

We normalize the average income of the potential customers \( \omega \) to 1. Given that \( E[\omega] = \bar{\omega}^2/3\bar{u} \), the normalization implies \( \bar{\omega} = \sqrt{3}\bar{u} \). In the model, this is the lifetime income that the client puts at stake in case of STD infection. Therefore the correct interpretation of \( \omega \) is of the value of residual life: a rational individual trades off the instantaneous benefit of intercourse with a sex worker with the risk of losing a significant portion of the value that they attach to their lives.
Consistently with the evidence reported by the ISTAT about the average earning differential between men and women in Italy, we set $E[hu] = 0.93E[\omega]$, which entails $h = 0.93(\bar{\omega}^2/\bar{u}^2) = 0.93(3/\bar{u})$. If we interpret $\omega$ as a value of residual life, then this assumption implies that the monetary value associated to life is proportional to the income that the individual expects to earn. For the utility function $v$ we choose a CRRA specification for both customers and sex workers, $v(x) = x^{1-\eta}/(1 - \eta)$ and we set the risk aversion parameter $\eta = 3^4$.

The most challenging part of the parametrization entails STD prevalence and their transmission probabilities. The foremost concern is the transmission of the HIV virus, which leads to the life threatening AIDS. But there are 5 other major STD: Syphilis, Herpes (HSV2), Chlamydia, Gonorrhea and Hepatitis B. We choose to abstract from the direct disability caused by the first 4 of them because it is very small, especially in a developed country like Italy: they are all resolved within few days and they generally do not lead to major complications. However we consider an indirect effect, since such infection significantly increase the probability of contracting the HIV virus. We also abstract from Hepatitis B, but not because of the induced disability and complications that, unfortunately, are quite substantial, but because of the existence of a safe and effective vaccine. Thus our modeling of the health risk is centered around AIDS.

From D’antuono et al. (2001) we learn about the prevalence of those AIDS in the population of Italian sex workers, which is 1.6%. We also use the total prevalence of the other STD, which is 21% assuming independence of infection. In Giuliani et al. (1998) we find data on STD prevalence in the Italian male population, which is 1% for AIDS and 38% for all others.

For the transmission probabilities we rely on the study by Gertler et al. (2005) and on the medical literature (see Table 1 in the Appendix for details). The transmission probabilities of HIV are 1.4% per intercourse if one of the two subjects is infected with another STD, while 0.5% if the subjects are not infected. Assuming independence of infections, we have

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There exist a large empirical literature on the degree of relative risk aversion. Attanasio, Banks and Tanner (2002) provide an estimate of 1.44 relying on portfolio allocations. Cicchetti and Dubin (1994) provide an estimate of 0.6 using data on insurance policies. There is also a vast experimental literature that provides estimates of the risk aversion ranging from almost zero to 20.
a probability of 0.67 that the customer or a prostitute that exchanges sex are affected by a STD. Calculating a simple weighted average, we obtain an HIV transmission probability of 1.1% for both customers and sex workers (0.5%*0.33+1.4%*0.67). Multiplying the total stock of infected individuals by the transmission probabilities, we obtain a total HIV risk of 0.0084% for sex workers and 0.01% for customers.

The next step entails computing the loss associated to the HIV infection. We compute \(1 - \alpha_{\text{hiv}}\) as the ratio between the present discounted value of life in case of HIV infection and the present discounted value in case of no infection. The interesting feature of this computation is that we don’t have to take a stand about the value of one year of life, since it cancels out in the computation of the ratio. We first need to compute the value of life without HIV infection. We use a collection of surveys and field studies on different aspects of prostitution conducted from 2000 to 2008 by the "Gruppo Abele" (GA henceforth), a non-profit organization that helps street prostitutes. According to several surveys carried out by GA, the average age of a client is 40 years. This figure is also similar to the average age of the male population as reported by ISTAT, which is 43 years, including young individuals aged less than 14 and old individuals aged more than 65, which we do not consider as potential clients. But since they account for, respectively, 14% and 20% of the overall population, it is likely that the true average age of a potential customers is indeed close to 43 and somehow smaller than that. Data from the ISTAT also indicate an expected life at birth of 78 years for a male. Therefore the average customers has roughly 40 years of expected life ahead. If \(r\) is the yearly interest rate and \(y\) the yearly income then the lifetime residual income without infection is \(Y^0 = \sum_{t=0}^{40} y/(1 + r)^t\).

Second, we need an assessment of the losses due to HIV infection. We follow Gertler et al.(2005) who assign a disability weight of 0.135 to the first years of infection before the outbreak of the disease, which are associated to mild symptoms and in setting the median duration of this period in 8 years. We assign a disability weight of 0.505 to the years after the outbreak of the diseases, which unfortunately, leads to death in a median time of 2 years. The residual value of life in case of HIV infection is:

\[
Y^{\text{hiv}} = \sum_{t=0}^{8} \frac{(1 - 0.135)}{(1 + r)^t} y + \sum_{t=9}^{10} \frac{(1 - 0.505)}{(1 + r)^t} y.
\]
According to our definition $1 - \alpha_{hiv} = Y^{hiv}/Y^0$ so that $\alpha_{hiv} = 0.706$.

In a previous version of the paper we considered a second health risk, a complication of Gonorrhea and Chlamydia that occurs in 22.5% of the cases, the Pelvic inflammatory disease (PID) for women and the epididymitis for men. Using medial data and the disability weight in Gertler et al. (2005), we found $\pi_{sw}^{pid} = 1.23\%$, $\pi_{c}^{pid} = 0.98\%$ and an expected loss of $\alpha_{pid} = 0.003$. Since the results were not affected by this inclusion, we decided to focus our attention on AIDS only.

We then calibrate the two remaining parameters $\bar{u}$, and $\bar{k}$ to match the fractions of customers and sex workers in their respective populations.

Since GA reports that only a negligible percentage of prostitutes is made up by men, we use national population surveys which try to identify clients of female sex workers by asking men about their sexual partners, which include the number of times that the men actually paid for sex. We are aware of two such surveys for Italy, one reported in Hubert et al. (1998) and another reported in the EU New Encounter Module Project. They estimate the percentage of male clients to be, respectively, $2\%$ and $1.7\%$ of their respective populations. Consistently with this evidence, we set our first calibration target to $1.85\%$.

We follow Vandepitte et al. (2006), who defines the female sex workers prevalence as the proportion of female sex workers in the adult female population (15–49 years). We set our second target to $0.4\%$ consistently with the evidence for Italy.

The calibration procedure results in the following values: $\bar{u} = 42$ and $\bar{k} = 0.18 \cdot (10^{-3})$.

### 4.2 Model Assessment

To assess if the model is a reasonable description of the Italian prostitution market, we observe the behavior of the equilibrium price, which is the only non-calibrated quantity and, therefore, the natural test variable. The problem is that the magnitude of the price is the same as the magnitude of $\omega$, which means that, to correctly interpret the price, we need to have an idea of the actual value of $\omega$. We proceed as follows: first, we compute the average price of sex transaction. Then, we compute the value of $E[\omega]$ which, in the model, implies the observed level of the price. Finally, we compare this $E[\omega]$ to a some measure of the permanent income of the average individual in Italy.
For the average price of the sex transaction we consider the prices reported in a study by the EURISPES (Istituto di Studi Politici Economici e Sociali)\(^5\). The average price reported by an African sex worker is between 10 and 20 euros, while the average price reported by an Eastern European sex worker is between 20 and 30 euros. For an actual price between 15 and 25 euros (depending on the respective shares of African and Eastern European sex workers), the implied value of \(E[\omega]\) is between 3.8 and 6 million euros. The question is if this is a reasonable figure for the value of residual life of a potential customer.

According to GA the typical clients of street sex workers are single while the typical clients of indoor sex workers are married. According to the ISTAT, the average income of a single in Italy in 2007 was 16 thousand euros. The median income for married individuals, with families that consist of more than 2 people, was 30 thousand. But this latter figure corresponds to the family income, which can also be provided by the spouse (ignoring single parents households that are not very common for male head-of-household) of the potential client and, therefore, must not be considered part of what the client stands to lose in case of health shock. We coarsely assume that this family income is provided by equally by two working family components, which entail assuming 15 thousand euros income per working member. A weighted average of the income results into slightly more than 15 thousand euros. Considering an interest rate of 3%, an average residual life of 40 years and 15.5 thousand euros of average income we obtain a permanent income of 380 thousand euros. Thus to make the model consistent with the data, we need the value of life to be 10 to 16 times bigger than the income. Viscusi (1993) in his review of 27 previous studies, reports a value of a year of life between 1.4 and 28 times the annual income, which is perfectly in line with our model.

Participating to the prostitution market either as a client or as a sex worker is a somewhat risky activity. This is true not only for potential costs related to STD – which are explicitly encompassed in the model – but also for other potential costs mainly related to the necessity to interact with a violent and illegal environment. This most likely implies that the average person who participate in this market is unlikely to be “average” in term of risk aversion. This is true especially for clients for the following reasons: first, because, unlike the sex workers the

\(^5\)Aperto per ferie - Indagine sul mercato del sesso a pagamento August 2003 Available at: http://www.eurispes.it/
clients’ participation to the market is arguably voluntary; second because many clients are willing to pay substantially larger sums for risky unprotected sex. For those reasons it might well be that sex workers are more risk averse than their clients. We explore this hypothesis assessing the model performance when we vary the relative risk aversion parameter of clients and sex workers.

The upshot of the results is that increasing the risk aversion parameter of the sex workers (and recalibrating the model) implies a higher risk compensation required by them and, therefore, a higher equilibrium price. Quantitatively speaking, increasing the risk aversion from 3 to 4 raises the price by a factor of 2.5. If the risk aversion parameter is as high as 6, the factor becomes 15. In both cases the value of life implied by the model falls within the bounds identified by Viscusi.

5 Policy analysis

We now use the benchmark model to evaluate the effects of alternative policies on the total quantity of prostitution exchanged in equilibrium and the harm associated to it. First, we simulate the prohibition regime and compare two opposite approaches to prohibition which we label Sweden and US. We then compare regulation and laissez-faire and we conclude the section comparing regulation with prohibition.

5.1 Prohibition: US vs Sweden

The objective is twofold: we want to compare prohibition with laissez-faire and, at the same time, compare different approaches to prohibition. To carry on our first comparative static exercise, we set taxes and prevention to zero and we fix the sanctions in case of enforcement to be equal to the equivalent of one week of lifetime value, which is the same as assuming a mandatory sentence of one week in jail for the individuals punished for prostitution. The first (not surprising) result is that an increased enforcement probability decreases both quantity and harm with respect to the laissez-faire benchmark.

If we instead fix the enforcement probability and we vary the sanction associated to the arrest we can compare two opposite approaches to prohibition: the Swedish
approach, where it is illegal to purchase sexual services but not to sell them\textsuperscript{6} and the American, where sex workers are the ones who bear most of the sanctions\textsuperscript{7}. Figure (1) summarizes the result from this exercise. The Swedish approach is analyzed keeping $F_{sw}$ at zero and increasing $F_{c}$, while the American keeping $F_{c}$ at zero and increase $F_{sw}$. In both cases we fix the enforcement probability to 5\%. All the quantities are expressed in units of the corresponding quantities prevailing under laissez-faire. As the picture clearly shows, the Swedish choice to punish clients is preferable to the American alternative. Moreover, since in the prohibition regime there is only one (illegal) market, this is true both in terms of quantity than of harm reduction.

5.2 Regulation: Taxing a Legal Market

Figure (2) summarizes the comparative static results for different levels of the tax rate. All the quantities are expressed in units of the corresponding quantities that prevail in a laissez-faire regime, with the exception of the government revenue, which is expressed in units of the numeraire. The pictures are drawn assuming again 5\% enforcement probability and the absence of extra risk associated to the illegal market, i.e. $\pi^c = \pi^c(p)$ and $\pi^{sw} = \pi^{sw}(p)$. The sanction is assumed equal to a one-week equivalent of the income.

In a regime of laissez-faire, all the prostitution is supplied in the legal market. Introducing taxes for the sex workers displaces part of the supply in the illegal market and higher tax rates are associated to bigger illegal quantities and smaller legal quantities. Overall the total quantity is decreasing in taxes, which means that the legal quantity decreases faster than the illegal increases. If the tax rate is high enough, there is no supply in the illegal market as if in a regime of prohibition. Further increases in the tax rate beyond this point are inconsequential for the equilibrium quantities. The cutoff tax rate level above which only the illegal market prevails in equilibrium depends upon enforcement: a higher enforcement probability or a higher fine imply a higher cutoff, simply because it is more costly to engage in the illegal market.

\begin{table}[h]
\centering
\begin{tabular}{ |c|c|c| }
\hline
Tax Rate & Legal Quantity & Illegal Quantity \\
\hline
0% & 100 & 0 \\
10% & 90 & 10 \\
20% & 80 & 20 \\
30% & 70 & 30 \\
40% & 60 & 40 \\
50% & 50 & 50 \\
60% & 40 & 60 \\
70% & 30 & 70 \\
80% & 20 & 80 \\
90% & 10 & 90 \\
100% & 0 & 100 \\
\hline
\end{tabular}
\caption{Comparative Statics of Legal and Illegal Markets with Respect to Different Tax Rates}
\end{table}

\textsuperscript{6}The Act Prohibiting the Purchase of Sexual Services, Brottsbalken [BrB] [Criminal Code] 6:11 (Swed.)

\textsuperscript{7}For example Heiges (2009) reports that “...in the Chicago district with the highest concentration of prostitution-related arrests, persons in prostitution accounted for 89\% of arrests in 2002, while purchasers represented only 10\% ”
If both markets coexist, the behavior of total harm depends upon the health risk differential. In the absence of prevention policies, and so in the presence of an equal health risk, total harm is decreasing in taxes until the tax rate is so big that only the illegal market prevails, and otherwise constant. If there is an extra health risk associated to the illegal market, then the increase in illegal quantities associated to a higher tax rate increases harm. However, total harm decreases as an effect of the decreased total quantity. The first effect prevails if the extra risk is big enough to compensate the smaller increase in the illegal quantity with respect to the legal decrease. For the baseline model parameters, the second effect prevails for all reasonable magnitudes of the extra-risk reductions.

The model exhibits a Laffer curve property: the total government revenue is first increasing in the tax rate and then decreasing. The total revenue from taxes behaves as a textbook Laffer curve between $t = 0$ and the threshold tax rate level beyond which only the illegal market prevails.

### 5.3 Regulation: Fighting the Illegal Market

Figure (3) summarizes the comparative static results for different enforcement probabilities. The picture is drawn assuming a tax rate of 20% and, as before, the absence of extra risk associated to the illegal market and a one week equivalent fine.

For the baseline model parameters, it is never convenient to exchange prostitution in the legal market for low levels of enforcement. Within this range of probability values, an increase in enforcement determines a decreased illegal, and therefore, total quantity, this is the region where enforcement is more effective. Eventually the increase in enforcement becomes big enough so that supplying in the legal market becomes convenient for a measure of individuals and both markets coexist in equilibrium. Increases in enforcement are then associated to an increased legal quantity and a decreased illegal quantity. For very big enforcement probabilities it is never convenient to supply in the illegal market. Further increases in enforcement beyond this level will have no effect on the equilibrium. But the enforcement probabilities for which this happens are too big to be reasonable. The two cut-off values of the enforcement probability that determines the switch between market regimes depend on the tax rate: a bigger tax rate, which makes the legal sector less attractive, is
associated to higher thresholds.

When in equilibrium only the illegal market prevails, total harm decreases because of the decreasing illegal quantity. If both markets coexist, the behavior of total harm depends upon the health risk differential. In the absence of prevention policies, and so in the presence of an equal health risk, total harm is decreasing in enforcement until the enforcement rate is so big that only the illegal market prevails, and otherwise constant. If there is an extra health risk associated to the illegal market, then the decrease in illegal quantities associated to a higher enforcement rate decreases harm.

The government revenue from taxes tracks the behavior of the legal quantity.

5.4 Regulation: Health Policies

Figure (4) summarizes the result for a prevention policy that reduces the stock of infected individuals in the populations of customers and sex workers from, respectively, 1.6% to 0.16% and from 1% to 0.1% in a parallel fashion (i.e. the same decrease in the stocks for both categories). Once again the picture is drawn assuming a tax rate of 20%, a 5% enforcement probability and a one week equivalent fine. Reducing the stock of infected individuals has the same effect of a reduction in the transmission probability of the disease maybe by diffusing the use of condoms\textsuperscript{8}.

A lower risk, making the legal market more attractive, is associated to a bigger legal demand and to a smaller illegal demand, which translate into a bigger legal quantity and a smaller illegal quantity. Overall, the total quantity is increasing and the effect is quantitatively very big. If only the legal market prevails in equilibrium, as it is the case if the tax rate is very small or if the enforcement probability is very high, then the only effect of an increased prevention is an increase of the total quantity. Viceversa, for big tax rates or small enforcement probabilities, when only the illegal market prevails, this prevention policy has obviously no effect on the model equilibrium. A decreased health risk is associated to

\textsuperscript{8}Rao et al. (2003) notice that: “Sanctions against condom free sex could also be instituted and enforced by the government but this may require the legalization of the profession. This strategy was pursued by the city of Calcutta and it proved effective at increasing condom use to almost universal levels and at keeping the HIV incidence at a very low level, around 6 per cent, compared to about 60 per cent in red light areas of comparable cities like Mumbai where no policies were implemented ”.
a smaller harm for all the legal transactions and to a smaller number of illegal transactions. However it is also associated to a bigger number of legal transactions. For small reduction of the infection probability the latter effect prevails and therefore harm is increasing in prevention. This interesting backfiring effect of the health policies is similar to the one found by Greenwood et al. (2010) in their model of sexual behavior and HIV/AIDS transmission. They write that “Even small policy changes aimed a curbing the spread of the virus may lead to an increase in the HIV/AIDS rate caused by the behavioral responses. Specifically, when sex becomes less risky, people engage in more risky behavior along several margins. They have more sex, use less condoms, and substitute away from (safer) long-term relationships into more casual sex”.9

Finally the Government revenue is increasing as an effect of the increased quantity but becomes decreasing when the prevention policies are very effective, as an effect of the decreased legal price.

We also look at the effect of an asymmetric prevention policy where only one transmission probability is reduced. Indeed, this might be the case, for instance, if sex workers must pass a medical exam to work in the legal market or if customers must pass a medical exam in order to legally purchase sex. The result from this analysis are summarized in figures (5) and (6). The main insight is that a policy that decreases the probability of contagion for the sex workers, for instance by imposing some controls on the customers, is preferable: The increase in the total quantity is rather small and the policy is not prone to a backfiring effect for low levels of prevention. To put it differently, total harm is always decreasing.

5.5 Regulation versus Prohibition

We conclude the section comparing regulation to prohibition. Figure (7) summarizes the comparative static results for different levels of the tax rate. All the quantities are expressed in units of the corresponding quantities that prevail in the prohibition regime. The pictures are drawn assuming a 5% enforcement probability and a sanction equal to a one-week equivalent of the lifetime income. The above graph are characterized by the absence of prevention, i.e. absence of extra risk associated to the illegal market. The below graphs are characterized by

9On the HIV/AIDS epidemic and the fight against it see also Kremer (1996) and Oster (2005).
a 50% reduction in the transmission probability from clients to sex workers, the asymmetric policy which has been shown to be most effective. In other words, in the spirit of Becker et al. (2006), we compare the effectiveness of a prohibition approach with a tax on legal production that punishes only producers who try to avoid the tax through illegal production. While they show that the monetary tax on a legal good (regulation) could cause a greater reduction in output and increase in price than optimal enforcement against production when the good is illegal (prohibition), our quantitative exercise shows that considering that some sex workers may go underground to avoid the tax, legalizing prostitution and taxing it will reduce the total quantity of prostitution exchanged in equilibrium with respect to laissez-faire (Section 5.2) but not with respect to a prohibition regime (left-hand side graphs). However, legalizing prostitution can be more effective than prohibition in alleviating the harm associated with prostitution (right-hand side graphs). For the example at hand (zero versus 50% prevention) increasing prevention increase total quantity by about 5% and decreases harm by more than 10%, this trade off is true for any prevention above 20%. Specifically, for the baseline model parameters, while prohibition is always more effective in decreasing quantity, regulation minimizes harm for any prevention level above 20%.

6 Conclusion

Our goal is to inform the policy debate on prostitution. We showed that a prohibition regime with enforcement targeted to the customers is the best regime if the social goal is to minimize the total quantity of prostitution exchanged in equilibrium. However making prostitution legal, taxing it and performing health policies on the legal market is the best strategy if the goal is to reduce the harm associated to prostitution. This is as far as we can go without making any judgment about which social goal is worth pursuing. We can only notice that the welfare of a very large number of people is at stake, some of which are exploited and enslaved.
Table 1: STD and Health Risk

<table>
<thead>
<tr>
<th>STD</th>
<th>Prevalence</th>
<th>clients</th>
<th>%</th>
<th>sex workers</th>
<th>%</th>
<th>Transmission prob.</th>
<th>prob. no STD</th>
<th>%</th>
<th>STD</th>
<th>%</th>
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<tr>
<td>AIDS</td>
<td>Prevalence</td>
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<td></td>
<td></td>
<td></td>
<td>World Health Organization</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>D’Antuono (2001)</td>
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<td>1.6%</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Transmission prob.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Gertler et al. (2005)</td>
<td>0.5%</td>
<td></td>
<td>1.4%</td>
<td></td>
</tr>
<tr>
<td>HSV2</td>
<td>Prevalence</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Giuliani et al. (1998)</td>
<td>9.6%</td>
<td>2%</td>
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<td></td>
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<td></td>
<td></td>
<td></td>
<td>D’Antuono (2001)</td>
<td>2%</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Chlamydia</td>
<td>Prevalence</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Giuliani et al. (1998)</td>
<td>7.8%</td>
<td>6.3%</td>
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<td></td>
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<td>D’Antuono (2001)</td>
<td>13.3%</td>
<td>12%</td>
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<td>Syphilis</td>
<td>Prevalence</td>
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<td></td>
<td></td>
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<td>0.9%</td>
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<tr>
<td>Gonorrhea</td>
<td>Prevalence</td>
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<td></td>
<td></td>
<td></td>
<td>D’Antuono (2001)</td>
<td>0.9%</td>
<td></td>
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</tr>
</tbody>
</table>

References


Figure 1: Prohibition: US vs Sweden

Notes: Equilibrium quantities under regulation for different levels of the fines. Clockwise from the upper left corner: (1) Total quantity of prostitution exchanged in equilibrium in units of the total quantity under lassiez-faire for fines on customers only, sex workers only and on both. (2) Equilibrium price in units of the price under lassiez-faire for fines on customers only, sex workers only and on both. (3) Total Harm in units of harm under lassiez-faire for fines on customers only, sex workers only and on both.
Figure 2: Regulation: Taxes

Notes: Equilibrium quantities under regulation for different levels of the tax rate. Clockwise from the upper left corner: (1) Total quantity of prostitution exchanged in equilibrium and quantities exchanged in the legal and illegal markets in units of the total quantity exchanged in a laissez-faire regime. (2) Equilibrium prices in the legal and illegal markets in units of the laissez-faire price. (3) Total Harm in units of harm under laissez-faire. (4) Total Government revenue in units of the model numeraire.
Figure 3: Regulation: Enforcement

Notes: Equilibrium quantities under regulation for different levels of the enforcement probability. Clockwise from the upper left corner: (1) Total quantity of prostitution exchanged in equilibrium and quantities exchanged in the legal and illegal markets in units of the total quantity exchanged in a laissez-faire regime. (2) Equilibrium prices in the legal and illegal markets in units of the laissez-faire price. (3) Total Harm in units of harm under laissez-faire. (4) Total Government revenue in units of the model numeraire.
Figure 4: Regulation: Symmetric Health Policies

Notes: Equilibrium quantities under regulation for different levels of the stock of infected individuals in both the populations of customers and sex workers. Clockwise from the upper left corner: (1) Total quantity of prostitution exchanged in equilibrium and quantities exchanged in the legal and illegal markets in units of the total quantity exchanged in a laissez-faire regime. (2) Equilibrium prices in the legal and illegal markets in units of the laissez-faire price. (3) Total Harm in units of harm under laissez-faire. (4) Total Government revenue in units of the model numeraire.
Figure 5: Regulation: Customers Health Policies

Notes: Equilibrium quantities under regulation for different levels of the stock of infected individuals in both the population of customers. Clockwise from the upper left corner: (1) Total quantity of prostitution exchanged in equilibrium and quantities exchanged in the legal and illegal markets in units of the total quantity exchanged in a laissez-faire regime. (2) Equilibrium prices in the legal and illegal markets in units of the laissez-faire price. (3) Total Harm in units of harm under laissez-faire. (4) Total Government revenue in units of the model numeraire.
Figure 6: Regulation: Sex Workers Health Policies

Notes: Equilibrium quantities under regulation for different levels of the stock of infected individuals in both the population of sex workers. Clockwise from the upper left corner: (1) Total quantity of prostitution exchanged in equilibrium and quantities exchanged in the legal and illegal markets in units of the total quantity exchanged in a laissez-faire regime. (2) Equilibrium prices in the legal and illegal markets in units of the laissez-faire price. (3) Total Harm in units of harm under laissez-faire. (4) Total Government revenue in units of the model numeraire.
Figure 7: Regulation vs Prohibition

Notes: Equilibrium quantities under regulation for different levels of the tax rate and different health policies. Clockwise from the upper left corner: (1) Total quantity of prostitution exchanged in equilibrium and quantities exchanged in the legal and illegal markets in units of the total quantity exchanged in a prohibition regime. No health policies. (2) Total Harm in units of harm under prohibition. No health policies. (3) Total quantity of prostitution exchanged in equilibrium and quantities exchanged in the legal and illegal markets in units of the total quantity exchanged in a prohibition regime. Health policy that reduces the stock of infected individuals by 50%. (4) Total Harm in units of harm under prohibition. Health policy that reduces the stock of infected individuals by 50%.