Prostitutes, Pimps, and Brothels: Intermediaries, Information, and Market Structure in Prostitution Markets

Amy Farmer* and Andrew W. Horowitz†

Prostitution is a multi-billion dollar, globally distributed, low-concentration service industry that is receiving increasing attention in the economics literature. This article focuses on a widespread, but little studied, feature of this environment—the role of intermediaries (pimps or brothel owners) on market outcomes. Prostitution laws and markets are perhaps unique in that transactions between principals (prostitutes and Johns) are legal in many countries, while intermediary activity (pimping) is illegal. After surveying the varying cross-country legality of agents we develop a simple theoretical model to analyze how the presence or absence of intermediaries shifts the distribution of market surplus. We show that eliminating pimps and brothels may shift surplus in non-obvious ways, depending on the precise function they perform and on whether equilibrium is pooling or separating across “high quality” and “low quality” market segments. The implications of alternative policy regimes (intermediaries legal or illegal) are considered.

JEL Classification: J2, J3, J4, K2, K4

1. Introduction

Prostitution is a multi-billion dollar, globally distributed service industry that is receiving increasing attention in the economics literature. This article analyzes the important role intermediaries (pimps or brothels) typically play in this market and sheds light on the unusual dichotomy that in many countries an un-intermediated transaction between prostitute and John (the principals) is legal, but the use of an intermediary (pimp or brothels) is illegal. Our analysis answers a fundamental question in this context that has not been subject to prior analysis: How does the presence or absence of intermediaries impact the surplus of the principals and the structure of the market? To answer this question we develop a simple theoretical model that examines three potential functions of intermediaries: They may lower prostitutes’ costs (e.g., security costs); they may regulate supply to increase market power; and/or they may transmit

* Department of Economics, Room 402, Business Building, Sam M. Walton College of Business, University of Arkansas, Fayetteville, 72701, USA; E-mail afarmer@walton.uark.edu; corresponding author.
† Department of Economics, Room 402, Business Building, Sam M. Walton College of Business, University of Arkansas, Fayetteville, 72701, USA; E-mail horowitz@walton.uark.edu.

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1 Important recent contributions discussed in the literature review include Edlund and Korn (2002), Cameron (2002), Moffat and Peters (2004), Gertler et al. (2005), Arunachalam and Shah (2008), and Della Giusta, Di Tommaso, and Strom (2009b).
information. Our analysis reveals that the presence of intermediaries may shift surplus in non-obvious ways, depending on which function they perform and on whether equilibrium is pooling or separating across “high quality” and “low quality” market segments.

The legality of both prostitution and prostitution intermediaries varies greatly across countries. In many countries adult prostitution is legal, but pimping is not (e.g., France, United Kingdom, Italy, Brazil, Chile, and Mexico). In other countries both prostitution and all intermediaries are illegal (e.g., United States). Another pattern common in Latin America is differential legality for different intermediaries. For example, operating a brothel (a prostitution enterprise with a fixed location) may be legal, while an intermediary without a fixed location (a pimp) is illegal (e.g., Guatemala, El Salvador, and Colombia).

Finally, both prostitution and all forms of intermediation are legal in some countries (Nicaragua, Greece, and New Zealand, for example). This differential legality of principal and intermediary has few parallels in other markets.

In addition to the varied legality of agents across countries, prostitution markets tend to be highly segmented. That is, it is common for a market in which customers are highly sensitive to stigma and/or disease to coexist with a distinct market for “less sensitive” customers. In the high-sensitivity segment, very sophisticated intermediaries are common. In the United States, for example, the infamous Hollywood and Washington “Madams” (Heidi Fleiss and Deborah Palfrey, respectively) operated highly efficient enterprises employing advanced businesses practices and health monitoring technologies. Simultaneously, in most countries there exists a low-end market in which prostitutes vend directly to Johns or street pimps provide very basic agency services.

Our analysis indicates that the function(s) intermediaries perform dictate the welfare changes that accompany their elimination. In most cases our analysis reveals that while the presence of intermediaries may increase or decrease consumer surplus, it rarely diminishes producer surplus. These results may have important policy implications. If the popular notion that pimps are exploitative of suppliers is untrue (at least in the purely economic dimension), the burden of laws that asymmetrically target intermediaries could fall unintentionally on the potentially most vulnerable principal (i.e., suppliers). More specifically, laws that target street pimps but allow brothels are likely to harm the lowest income suppliers while supporting those that supply a higher quality product. If consumers are disproportionately represented in crafting legislation, the legal targeting of intermediaries can be viewed cynically as being in (some) legislators’ self-interest, since under certain conditions we will identify the elimination of

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2 It is important to note that, while we refer to legality and illegality in a dichotomous way, there are various ways to interpret this that may indicate a more continuous reality. Not only might variance in regulations indicate a less dichotomous situation, the extent of enforcement also creates this reality. Although in this article we talk about legality and illegality as sharp differences, we model a cost that can range from 0 to infinity. Moreover, we first model the situation as if it were legal in order to compare the various market structures and then simply discuss the role of agents and how their disappearance or appearance will alter the equilibrium. As such, a dichotomy between legal and illegal does not play a role in this article.

3 In the United States, prostitution is only legal in some rural counties of the State of Nevada.

4 An alternative (but not mutually exclusive) explanation for this pattern is capture-theoretic behavior. For example, legal brothels may lobby the government to eliminate the competition from pimps.

5 In the United States, “escort services” constitute a large, poorly regulated market segment serving primarily mid- and upper end demanders. Indeed, the madams noted above operated largely as escort services. See Reynolds (1986) for a taxonomy of prostitution services in the United States.
intermediaries’ benefits demanders; under other conditions, the presence of high end
intermediaries (brothel owners) can be beneficial to both high end demanders and suppliers.

The remainder of the article is organized as follows: Section 2 provides a literature review
and additional background material. Section 3 develops a formal model and characterizes the
impact of intermediaries on the distribution of market surplus and the conditions under which
pooling, separating, or no pure strategy equilibria arise. Section 4 concludes, interprets, and
offers extensions.

2. Background and Literature Review

The debate within the sociology, economics, and feminist literature as to whether
prostitution is prima facie exploitative is not addressed in this article (see DeRiviere [2006] and
O’Connell Davidson [1998] for a discussion). Similarly, the important related topics of human
trafficking and child prostitution are not addressed, and the model developed herein is
explicitly inappropriate for consideration of these topics (see Di Nicola et al. [2009] for
extensive review of trafficking issues). Rather, this article falls within the established economics
literature in which prostitution transactions are entered between consensual, rational, utility
maximizing individuals. While it is not our assertion that a utility maximizing framework can
address all the dimensions of this issue, we do believe it to be appropriate for analysis of
important aspects of this topic. We also note that narrative focus is on the “traditional”
prostitution market, rather than the online segment.* We will briefly discuss in the conclusion
how our model might be adapted to the online segment.

Though some general economic analysis of prostitution can be found in Reynolds’ (1986)
and Lim’s (1998) studies of the Asian context, the volume of work from the broader social
sciences is more extensive than in economics per se (see O’Connell Davidson [1998]). The
feminist economics literature provides a nice bridge between economics and the broader social
science frameworks (e.g., DeRiviere 2006). The focus in much of the economics literature per se
has, not surprisingly, been on price determination, information, and signaling. One important
strand of the literature seeks to explain the seemingly contradictory occurrence of free entry,
low-skill requirements, and high wages. Edlund and Korn’s (2002) explanation is that
participation in prostitution may foreclose entry into the marriage market. Consequently, even
though the skill set of suppliers is not restrictive nor entry barriers prohibitive, the opportunity
cost of the activity is high.^ This opportunity cost is driven in part by informational asymmetry
regarding paternity, which is potentially more acute in the case of (former) sex-workers.

Alternatively, Delia Giusta et al. (2009a) and Delia Giusta, Di Tommaso, and Strom (2009b)
focus on stigma to reconcile the low-skill/high-wage paradox and provide some supporting

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* See Moffatt and Peters (2004) and Logan and Shah (2009) for important treatments of the online market. Though the
online market is growing rapidly in some countries, the traditional market remains the larger sector in much of the
world.

^ The implications of information asymmetry for market efficiency and possible solutions through signaling have been
the subject of many economic analyses. Akerlof (1970) showed how informational asymmetry can lead our “pooling”
low quality market equilibrium. Spence (1973) shows how signaling mechanisms can solve market inefficiencies.

^ Arunachalam and Shah (2008) argue that a sample of Mexican and Ecuadorian prostitutes do not support Edlund and
Korn’s (2002) hypothesis, while Cunningham and Kendall’s (2011) findings are consistent with those of Edlund and
Korn.

Intermediaries (pimps and brothels) have received less formal attention in both the theoretical and empirical economics literature than have the pricing and risk-premium issues noted above. In our opinion, there is little convincing empirical evidence regarding the effect of intermediaries on the allocation of surplus or the dissemination of information in this market. DeRiviere (2006) presents interview data that indicate that agents extract a large share of earnings (37%). However, this statistic must be viewed with considerable caution, since the payments to “dependent partners” are aggregated with those to intermediaries, and these sex-trade workers are principally young, marginalized aboriginal women in an idiosyncratic setting (Winnipeg, Canada) and are subject to acknowledged selection biases. In another Canadian study, Benoit and Millar (2001) found that low-priced prostitutes (“street-based”) retain over 90% of their earnings, while higher priced suppliers utilizing more sophisticated intermediaries often saw up to 50% of their earnings extracted (Benoit and Millar 2001, pp. 43–4). One exception to the neglect of intermediaries is Reynolds (1986), who provides a rare, detailed description and analysis of the economic functions of pimps (see chapter 3, “Pimps”). In particular, she devotes considerable attention to the role of information asymmetries in the determination of market structure and intermediaries’ functions.

Our article extends the prior literature by formally incorporating intermediaries into a theoretical analysis of market structure with heterogeneous buyers and sellers and information asymmetry. (Prior literature has generally assumed a homogeneous market for commercial sex.) Our principal focus is how, in this context, intermediaries affect the distribution of surplus and how, given the informational asymmetry, the market may segment (i.e., separating equilibria). We will show that the presence of intermediaries shifts surplus in non-obvious ways depending on the precise function they perform in specific settings and on whether equilibrium is of the pooling or separating variety, and that these effects differ in a “high quality” versus a “lower quality” market.

3. Model

We assume two types of producers (high and low quality) and two types of consumers (quality sensitive and less quality sensitive). The simplest interpretation of producer “quality”

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9 Discrete consumer types are clearly a simplification, and we could alternatively assume a continuum of types. However, our model is convexified in probabilities, and we are able to demonstrate all results more simply with the discrete specification. Moreover, there is a discrete property to “quality” under the STD interpretation, since prostitutes are either infected or not. We will discuss this in greater detail subsequently.
types is that high quality \((H)\) suppliers are free of STDs with certainty, and low quality \((L)\) suppliers may be infected with some positive probability. Many other non-mutually exclusive interpretations of quality are possible (and reasonable).\(^{10}\) There are an exogenously determined large number of high quality suppliers \((m^H)\) and low quality suppliers \((m^L)\) in the market.

Buyers cannot determine the quality type with certainty ex ante, but they know the probability \((\pi)\) that a seller is high quality. In the interest of brevity we will directly specify the generic supply, demand, and associated reservation price functions for two types of producers and two types of consumers. The underlying optimization problems that generate these functions are presented in Appendix 1 and entail simple modifications of the standard consumer and producer problems. In Appendix 1 we motivate an important property of the reservation price functions for quality sensitive (type \(S)\) demanders and less quality sensitive (type \(N)\) demanders, which we denote as \(R^S(\pi, Y)\) and \(R^N(\pi, Y)\), respectively, where \(Y\) denotes the income of the representative consumer. This “crossing property” is illustrated in Figure 1.\(^{11}\)

The crossing property follows directly from assumptions imbedded in our model, which are in turn motivated by the observations reported in the introductory sections. Specifically, the upward slopes of the functions reflect the preference of all demanders for high quality to low quality at a given price. Second, the steeper slope of quality sensitive types reflects their greater marginal utility as the probability of low quality service falls. Third, the intercepts imply that quality sensitive demanders will not knowingly purchase a low quality service, while those less sensitive may (at a sufficiently low price). Finally, at high probabilities that the supplier is “high quality,” type \(S)\) demanders have a greater reservation price than type \(N\) demanders.

We now turn to the supply side of the market (again motivated in Appendix 1). Prostitutes’ supply of either a high quality or low quality product \((H)\) or \(L)\) is based on the presence of a dichotomous, exogenous, non-transferable endowment. Of course, prior choices

\(^{10}\) Alternative interpretations of ex ante unobservable quality might include “skill” or amicability. The “low quality” outcome could also be interpreted as having a higher probability of discovery, with the associated stigma costs.

\(^{11}\) Type \(N)\)’s reservation price function need not intercept the vertical axis, as shown. A horizontal axis intercept to the left of type \(S)\)’s intercept changes nothing as long as the slope of \(R^N)\) is less than \(R^S)\) and an intersection occurs.
determine this "endowment" if we interpret quality as being STD positive, or not. However, analysis of those prior decisions is beyond the scope of the current article. The non-transferable endowment determines the opportunity wage, which we denote as $w^H$ and $w^L$, respectively. Given a large number of each type with free entry and exit, the reservation producer wage is the opportunity cost of labor ($w'$) for the particular type ($H$ or $L$) plus expected costs (e.g., protection costs, solicitation costs, stigma, etc.): $w' + \gamma^sCz$, where $C$ are the costs incurred by the seller with some probability $\gamma^s$. It is assumed that $w^H > w^L$.

We first consider the equilibrium in which the opportunity cost (and hence the price) of a high quality seller is too great to attract the less quality sensitive buyer. These conditions are consistent with casual empiricism and allow us to analyze important features of the environment in a tractable manner. We will consider the equilibrium outcome in this market both in the case in which agents are absent as a result of legal prohibition and, subsequently, in the case in which producers may utilize agents.

**Market without Agents**

We assume that this is a competitive market characterized by asymmetric information regarding the quality of the supplier. When buyers cannot differentiate quality, we cannot assume a separating equilibrium in which distinct prices for the high quality and low quality service, $P^H$ and $P^L$, respectively, will prevail simultaneously. In fact, if there is no credible signal that allows buyers to distinguish between types, no separating equilibrium can exist. Without the credible signal, a low quality seller would deviate from $P^H$ and charge $P^L$ knowing that the buyer cannot differentiate his type. Of course, this assumes either a one shot game or a large enough market such that even if one buyer learns a seller at $P^H$ is actually low quality, the information does not disseminate throughout the market. In general, the assumption of significant barriers to information dissemination seems reasonable even where prostitution is legal, since stigma cost for both buyer and seller are often significant and the market is large. Moreover, even when unambiguously legal, tort action by a buyer against a seller for misrepresented quality is extremely rare. In such an environment many of the normal mechanisms that impose costs on quality misrepresentation do not function, and, as such, type $L$ sellers can assert high quality with little risk. Hence, the separating equilibrium collapses and leaves only the possibility of a pooling equilibrium at either $P^L$ or $P^H$. We consider each possible equilibrium in turn.

**Case 1: Pooling at $P^H$**

In this case, type $L$ suppliers charge $P^H$ knowing that they cannot be differentiated from type $H$ sellers. As such, consumers recognize that they are paying $P^H$ with only a probability $\pi$ that they are purchasing a high quality service. This equilibrium can be maintained if, at the given quality mix, there exists adequate demand that a sufficient number of buyers are willing to purchase. If at that competitive price with only a probability $\pi$ of receiving a high quality service the quality sensitive consumer is still willing to buy, the equilibrium can be supported. If that condition fails, then rather than be shut out of the market, low quality sellers will defect from this equilibrium and offer their services at $P^L$. In other words, this equilibrium is supported if and only if $R^S(\pi, Y) > P^H$. 

Case 2: Partial Pooling at $P^H$

If there are too few quality sensitive demanders, then those low quality sellers who do not find a buyer will offer their services at the low price to attract a type $N$ buyer. This does not change the fact that some low type sellers will continue to bluff and will get the higher price, because the quality sensitive consumer is still willing to purchase given the uncertainty. This then results in a partial pooling equilibrium in which both markets exist simultaneously, but buyers at the high price are not guaranteed a high quality service. As some of the population of sellers resorts to charging $P^L$, the probability of receiving a high quality service rises to $\pi' > \pi$. This equilibrium can exist if and only if there exists a value for $\pi'$ such that $R^H(\pi', Y) > P^H$, which is less restrictive than the reservation price needed to support a pure pooling equilibrium at $P^H$. At the equilibrium at $P^H$, quality sensitive buyers enter the market and serve the high end suppliers and the corresponding percentage of low quality sellers to support the probability $\pi'$. The remaining low quality sellers will fail to find clients at $P^H$ and will offer services for $P^L$.

We assume for the remainder of the article that pure pooling at $P^H$ is not possible. In other words, there are not sufficient quality sensitive buyers to purchase the services of all sellers of both types. As such, some unemployed type $L$ sellers will deviate and offer their services at $P^L$, and both prices will persist simultaneously. Note, however, that if partial pooling is supportable, then some type $L$ sellers receive the higher price as quality is not observable.

Case 3: Pooling at $P^L$

If the reservation prices of quality sensitive consumers are insufficient to support even the partial pooling equilibrium at $P^H$, pooling at $P^L$ can occur. In other words, if $R^H(\pi', Y) < P^H$ for all values of $\pi'$ that would clear the market, then quality sensitive buyers are not willing to pay $P^H$, given the probability of receiving a low quality service. In this case, type $H$ suppliers exit the market, as $P^H$ is their opportunity cost, and only type $L$ suppliers remain. Competition then forces the price to fall to $P^L$, and the equilibrium consists of type $L$ sellers only. If a high quality seller enters the industry charging $P^H$, low quality sellers will match that price, leaving type $S$ buyers facing a price $P^H$ for a mix of quality types. The process above then returns the price to $P^L$, and the equilibrium is supported given the low demand.

The cases noted above can be succinctly stated in the following proposition.

**Proposition 1.** In the case of asymmetric information regarding seller quality, two pooling equilibria are possible. Prices partially pool at $P^H$ if demand is sufficient to support a high price even when quality sensitive buyers are purchasing a high quality service with some probability. The remainder of the market is served by low quality sellers charging $P^L$. If demand fails to meet this condition, then equilibrium is supported with price $P^L$, and only low quality sellers remain in the industry.

**Proof.** See Appendix 2.

Given that the market for prostitution services is often characterized by unobservable quality differentiation, the question arises as to what missing element in the narrative above could lead to a separating equilibrium. An obvious missing element is the presence of seller
agents (intermediaries). In the section below we demonstrate the role intermediaries play in supporting the separating equilibria.

**The Market with Intermediaries**

A review of the sociology and descriptive literature indicates that intermediaries often perform several roles in this market (see Weitzer [2009] for an extensive review of the literature). The assumptions incorporated into our model, which are now enumerated, are motivated by this literature. First, we assume that they may be able to reduce the cost of supply to sellers. In the case of brothels, the cost reduction associated with sharing the fixed costs of the location and economies of scale in providing security are likely significant. Second, we assume that brothels as well as pimps can offer coordination among suppliers that can provide them with market power. Lastly, we consider that via this ability to coordinate they are also able to reliably signal high quality to the market. These modeling assumptions are not intended to dismiss or diminish the potential exploitative role of pimps or brothels emphasized in the feminist, sociology, and popular literature (and film). Rather, we seek to illuminate some less obvious economic implications of this agency relationship.

**Intermediaries' Function 1: Intermediaries Decrease Average Cost**

If a seller aligns herself with a brothel or pimp, the economies of scale in protection, location, or medical services decrease costs to $C' < C$. However, the intermediary must extract his own opportunity cost, making the net competitive price the sum of the seller’s costs plus that of the intermediary. If the reservation price of the intermediary (identified with superscript $A$) is the opportunity wage plus the expected costs of agency, then we can define the net reservation price to be $w^A + \gamma^A C^A$ (i.e., lost wages plus expected costs [legal fees/fines, jail time, stigma, etc.] when the probability of incurring these ex post costs is $\gamma^A$). Thus, the competitive equilibrium prices to support both a high quality and a low quality market with an intermediary who lowers supplier cost will be, respectively,

$$p^{HA} = w^H + \gamma^S C + w^A + \gamma^A C^A$$

(1.1)

$$p^{LA} = w^L + \gamma^S C + w^A + \gamma^A C^A.$$  

(1.2)

If $p^{HA} \leq p^H$ and $p^{LA} \leq p^L$, then the market is capable of sustaining agents who lower costs. In other words, they are able to lower costs enough to support their own opportunity cost and still reduce overall price. In this case, competitive sellers will be forced to employ an intermediary in order to maintain competitiveness, but given a competitive market they will receive no additional surplus beyond their opportunity cost. Depending upon which equilibrium the market was in initially, the entrance of agents will simply lower prices to the new minimum average costs, denoted $p^{HA}$ or $p^{LA}$ in Equation 1. As such, sellers' surplus is unchanged, and buyers receive a lower cost.

However, an alternative outcome is possible. If the market initially was in a pooling equilibrium at $p^L$, it is possible that the cost lowering effect is sufficient to change the market equilibrium to one that can now sustain a high end market. In other words, if $p^H > R^S(\pi', Y) > p^{HA}$ for some value of $\pi'$ that permits the market to clear, then quality sensitive consumers will
now be willing to buy a service of uncertain quality at this lower price, making the partial pooling equilibrium possible where it was not before. In this case, the market may switch from pooling at $P_L$ to partial pooling at $P^{H/A}$. Thus, while the introduction of agents into the market will never raise the price and may lower the price in a given equilibrium, it does raise the probability of moving to a new equilibrium in which some pooling takes place at the higher price. As such, quality sensitive consumers receive surplus, as the market for their service is now sustainable. Note that buyers benefit from the cost reductions, sellers charging $P_L$ receive the same surplus, and those sellers who "bluff" to $P^{H/A}$ increase their surplus. In a competitive market, the agents need only compensate them the value of their opportunity cost, which is what they received prior to their presence, and competition drives prices down to the sum of agent plus supplier opportunity cost. The results are summarized in Proposition 2.

PROPOSITION 2. When intermediaries lower costs and extract surplus to cover their opportunity cost and expected ex post cost, their presence will lower the prices in a given equilibrium, thereby potentially raising the welfare of buyers of both types. If the initial market only sustained a low quality service, then high demand buyers are not helped or harmed as the low price falls; however, their welfare will rise if high quality sellers’ costs can be reduced sufficiently to support a partial pooling equilibrium in which a high quality market now can be sustained.

PROOF. See Appendix 2.

COROLLARY. When intermediaries can lower supply costs, all buyers are either better off or no worse off as agents enter the market. Sellers’ welfare is either unchanged or improved.

Intermediaries’ Function 2: Provide Market Power

Suppose, alternatively, that intermediaries have an exogenously given ability to enforce cartel behavior. This capability may come from a physical ability to restrict entry (or output), eliminate competition, or enforce cooperation. If this cartel organizing capability exists, the introduction of intermediaries generates a higher price and two new potential prices for each market and, in turn, two new equilibria. If intermediaries are unable to provide this function in the market, their presence may be rationalized through the other functions previously discussed. In this section we consider this function in isolation, recognizing that it may coincide with cost lowering capabilities.

Suppose first that the market is in a pooling equilibrium at $P_L$ and that only type $L$ suppliers are participating. Abstracting initially from the possibility that intermediaries lower costs in order to isolate this market power effect, their cartelizing ability permits a higher price $P^{LC} > P_L$ (indicating the cartel price). Assuming this higher price is not sufficiently high to induce high quality suppliers to enter the market, we can conclude that the entrance of intermediaries into the market will generate higher prices at the same quality. Similarly, if the intermediaries entered a market that was initially partially pooling at $P^H$, their presence will result in a higher market price of $P^{HC} > P^H$ with a constant quality. However, it may be the

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13 There is an un-modeled bargaining process between the supplier and the intermediary that determines the division of the producer surplus gained from the higher cartel price. This discussion assumes only that this bargaining does not lead to the polar case of 100% surplus extraction by the intermediary. This is reasonable, since cartelization would increase the market price, benefiting suppliers outside of the cartel.
case that a market starting at a pooling equilibrium of $P^L$ may see a price rise to $P^{LC} > P^H$ (i.e., price may rise sufficiently high that high quality sellers will now enter). In this case the presence of intermediaries shifts the equilibrium to one with higher prices and higher average quality. However, the fact that the market was in the low priced pooling equilibrium to begin with implies that the market demand cannot support a price this high with both types of suppliers pooling in the market. Thus, we can rule out this possibility.

In terms of surplus distribution, in both cases the price is maintained above the competitive price; suppliers must be given some share of the rents or they will work independently at the lower competitive price. As such, some of the rents will be shared with sellers, and we can conclude that the presence of intermediaries raises the surplus of suppliers. However, in both cases demanders are unambiguously worse off, given that price rises and quality remains constant.

**Proposition 3.** If intermediaries' only function is to generate market power, they will generate higher prices at a given quality. Suppliers and intermediaries see a welfare gain, while demanders' welfare unambiguously falls.

**Proof.** See Appendix 2.

Note that the low price cannot exceed the original high price; we have assumed that $P^L$ exceeds the type A's reservation price and as such would eliminate the less quality sensitive market.

**Intermediaries' Function 3: Eliminate Asymmetric Information**

As noted in the Introduction it is possible that along with the ability to lower costs and/or restrict output, intermediaries may have the ability to credibly inform consumers of quality. This may or may not coincide with cost reduction or the ability to generate market power.

If intermediaries who work with high quality sellers expend the cost to reveal the information, the value of their service rises, given that demanders will no longer face some probability of a low quality service. Thus, we define the full information market equilibrium price for high quality to be $P^{HI} > P^H$, where $P^{HI} \leq R^S(\bar{\pi} = 1, Y)$. In other words, price will rise no higher than the reservation price of a quality sensitive consumer who knows with probability 1 that the service is high quality. Depending upon the degree of market power, the surplus created by this information may be shared, and as long as the cost of revealing this information is less than $P^{HI} - P^H$, intermediaries can enter the market and fill this role. For quality sensitive buyers, price has risen, but so has average quality. If the market is competitive (i.e., we are only examining the role of information sharing in isolation), then price reflects the opportunity cost of high quality sellers plus the cost of revealing the information (which is the opportunity cost of the pimp performing this service). If this does not generate surplus for quality sensitive buyers greater than that generated by a partial pooling equilibrium in which buyers face a probability of a high quality service at a lower price, then these buyers would prefer to purchase from sellers who do not employ a pimp at the lower price ($P^H$). Thus, this equilibrium can only be supported if intermediaries generate buyer surplus at the high end. In this case, quality sensitive buyers are better off, and less quality sensitive buyers are no worse off, as the price of the low quality service remains unchanged (at opportunity cost). High quality sellers are no worse off because they are guaranteed their opportunity cost. However, if absent the
Table 1. Effect of Intermediaries on Consumer and Producer Surplus

<table>
<thead>
<tr>
<th>Intermediary Function</th>
<th>Welfare Change for Buyers</th>
<th>Welfare Change for Sellers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lower costs</td>
<td>All buyers better or unchanged</td>
<td>Unchanged</td>
</tr>
<tr>
<td>Market power</td>
<td>All buyers worse</td>
<td>All sellers better or unchanged</td>
</tr>
<tr>
<td>Information transmission</td>
<td>Quality sensitive buyers better</td>
<td>High quality sellers better or unchanged</td>
</tr>
<tr>
<td></td>
<td>Less quality sensitive buyers unchanged</td>
<td>Low quality sellers worse or unchanged</td>
</tr>
</tbody>
</table>

intermediaries the high quality market could not be supported, then this information transmission of the agents will raise seller welfare. Also, if any of the buyer surplus is shared with the sellers then they are also better off. However, some low quality sellers had been able to receive high prices absent full information, and for those sellers welfare falls.

**Proposition 4.** The ability of intermediaries to reveal information will have no impact on consumers of low quality and will have a positive effect on the welfare of the quality sensitive consumers. Suppliers of high quality service are helped or see no impact, while those selling low quality services see their welfare remain unchanged or decline.

**Proof.** See Appendix 2.

**Corollary.** If the quality of information improves exogenously in the absence of intermediaries, then the available surplus for agents to generate falls, making them less likely to exist. Either way, less surplus is shared with high quality sellers, and, therefore, an exogenous decline in information uncertainty improves the welfare of high quality sellers. Other effects are as found in Proposition 4 (i.e., the improved information affects the remaining players the same whether it comes exogenously or through the presence of an agent).

The net effect of the presence of intermediaries is ambiguous. While the market power effect raises prices and decreases consumer welfare, the potential cost lowering and information revealing ability raises consumer welfare. All sellers are better off or no worse off with the exception of the low quality seller, who in some instances was able to get a high price absent full information. In general, quality sensitive buyers stand to gain the most; the presence of intermediaries raises the probability of a sustainable high quality market that may not even exist in their absence as well as raising the average quality of service to type S consumers by providing information. If \( R^\delta(1, Y) - R^\delta(\pi, Y) > P^{II} - P^H \), surplus rises as quality rises even though intermediaries create higher prices via market power. Low end buyers are affected by the negotiated surplus sharing with intermediaries, although one might expect that in the lower end market, the surplus shared with the supplier is likely to be small. If this is the case, then for different reasons we might expect that the presence of agents raises consumer welfare. Table 1 summarizes the effect of intermediaries on consumer and producer surplus in the market.

**Prostitution and Brothels Legal—Pimps Illegal**

As noted in the Introduction, it is not uncommon to find countries with legal prostitution and brothels but illegal pimps. Our model results, summarized in Table 1, provide some possible explanations for this dichotomy. First, brothels seem likely to augment the functions of

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14 These include Colombia, Costa Rica, El Salvador, Guatemala, Panama, Peru, Belgium, and Switzerland.
information transmission and cost reduction, rather than market power. Fixed location facilitates return business, so quality would be controlled, and cost sharing, economies of scale, etc., should lower costs. Moreover, simply being able to maintain a fixed location and operate in the formal sector is a quality signal in many developing countries. In our model, signaling quality helps type S buyers by improving their average quality service (as well as possibly making their market viable). Because of pooling (misrepresentation by low end buyers) without a meaningful way to signal quality, the high end market can collapse. So it seems that brothels very likely decrease uncertainty regarding quality and support the separating equilibrium, thereby benefiting both buyers and sellers in the high quality market. Of course, they could generate market power, but if brothels are legal a major barrier to entry has been removed so that the market power effect should be attenuated. "Market power" of brothels is more likely a factor when they are illegal and exist through corruption.

Pimps, on the other hand, as documented in detail by Reynolds (1986), have traditionally operated in the lower quality market, and the protection services they often provide likely lower costs in that dimension. In that case, the presence of pimps results in lower prices for low end buyers and helps sustain that market (recall suppliers exit if their reservation wage is not met). In this scenario the low quality market will have only the very lowest cost (reservation price) suppliers without pimps. However, since pimps’ quality signaling role (information) is often weak, their presence or absence may have little impact on the high end market. Thus, one empirical implication of our model is that in settings in which brothels are legal and pimps are illegal, the price spread in the low quality (street) and high quality (brothel) markets should be greater. Of course, whether pimps primarily serve the low end market may vary across locations. When the conditions outlined above are satisfied (pimps lower cost but do not transmit quality signals), differential legalities of pimps and brothels have specific effects on the high and low end market. Since we observe numerous cases of legal brothels and illegal pimps but no cases of the reverse, our theoretical framework provides some criteria for considering the effects of this pattern.

From a political-economy perspective various scenarios seem consistent with an incentive to legalize brothels but not pimps when pimping supports low end suppliers but brothels engage the higher end: First, (perhaps cynically), lawmakers may be high end buyers themselves and therefore derive greater benefit from the presence of brothels than of pimps. Second, if lawmakers are worried about exploitation of prostitutes, they might want to support high end suppliers and not low end sellers for multiple reasons. One might believe that higher end suppliers are more likely to be voluntary participants who choose this profession for the wage premium. While this may be true of lower end suppliers, it is easy to at least question whether facilitating that market is actually in the best interest of the suppliers. Further, a high end market with a fixed location facility is much easier to regulate, thereby protecting both buyers and sellers. So to the extent that agents help sustain the high end market, they allow the women with "high quality" (e.g., disease free) to appropriate a larger share of the surplus under the separating equilibrium, a goal that is likely to be consistent with policy-makers' agendas.

The model, then, is consistent with the real-world observation that brothels are favored by policy makers over pimps. To the extent that in reality pimps work in the lower end market and brothels serve a more quality sensitive clientele, the model predicts that a policy maker worried

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15 Reynolds' analysis and descriptions focus on the U.S. market but are likely applicable elsewhere.
about the exploitation of lower income sellers would regulate pimping more heavily than brothels.

4. Summary, Conclusion, and Further Research

Recent years have seen a significant increase in research on prostitution and a growing recognition that this globally distributed service industry is understudied and poorly understood. Though a number of significant contributions to both the theoretical and empirical literature have recently been made, a pervasive feature of this environment has been largely ignored—the role of intermediaries. Yet the treatment of intermediaries in this industry is perhaps distinctive—the authors are aware of few other settings in which principals may transact legally but are prohibited from employing intermediaries. This peculiarity raises a host of questions, some of which we address in this analysis. Our principal focus is on the question of how the presence or absence of intermediaries affects the distribution of market surplus between buyers and sellers. To answer this question we focus on three distinct functions of intermediaries: cost reduction, cartelization (market power), and information revelation. We show that the importance of each of these functions, together with demand conditions, determines their impact on the welfare of the principals. If the cost lowering impact of intermediaries dominates, then consumers are universally better off with their presence, and suppliers’ welfare remains unchanged. In this case, penalties that drive them from the market adversely impact consumers. Alternatively, if the market power function of intermediaries dominates, consumers are unambiguously worse off and sellers better off. Lastly, we turn to the information transmission function of intermediaries. Our model demonstrates that it is this function that impacts most directly the high end of the market, with high end consumers and suppliers unambiguously benefiting from the presence of intermediaries. Though media and public attention focus on episodes involving this segment of the market (i.e., politicians, athletes, and celebrities), the volume of transaction in this segment is likely dwarfed by the less visible “low quality” market.

Beyond the issues addressed by our model looms the analysis of the political economy of the crafting of prostitution laws—that is, the endogenous determination of agency illegality in its various forms. If legality is rationally determined, cross-country variation should reflect variation in market fundamentals and country “preferences” for the distribution of market surplus. Though beyond the scope of the current model, the large body of sociology and feminist literature indicates that the prostitutes themselves are likely the least empowered of the three players and are the least likely to have influence in the determination of penalty structure. If one considers the possibility that lawmakers in some countries may represent buyers (or may be buyers themselves), while in other locales they may truly desire policies to eliminate this market, there emerges a complex setting of endogenous penalty determination in need of additional study. If the policy goal is directed by attention to suppliers, whether the goal is to eliminate prostitution altogether or to eliminate the lower end form, which may be deemed more exploitative of women, will suggest different policies. Alternatively, a country’s policy may be directed by the desires of demanders, in which case price consequences and market information may be the guiding factors. Finally, we note that our model may be of relevance to the online market. In particular, adapted to the online segment our parameter π, which reflects the ex ante probability that a supplier is of high quality,
could be shocked by online information signaling innovations. For example, the emergence of the face signal strategy studied by Logan and Shah (2009) would shift the reservation-price functions of Figure 1, generating comparative static effects. These topics are the subject of ongoing research.

Appendix 1: Underlying Optimization Models

**Consumer Model**

**Utility**

\[ U_j(q_j, x), \]

where \( x \) is a continuous gross substitute composite good, \( q_j \) is prostitution services, and \( j = \{S, N\} \) differentiates the utility function of type \( S \) or \( N \), and \( q_j \) has an ex ante unobservable dichotomous quality dimension; \( i = \{H, L\} \), indicating "High" and "Low," respectively. It seems reasonable to assume for both utility functions that \( U_q > 0 \), \( U_{xq} < 0 \), \( U_{xx} < 0 \), and \( \lim U_x = +\infty \). While the utility functions have the usual assumed characteristics in \( x \) and \( q \), the available options for values of \( q \) are constrained to two discrete values. As such, a corner solution in prostitution services is possible, but not in the composite good. Since utility is increasing in \( q \) and \( q^H > q^L \), then \( U(q^H, x) > U(q^L, x) \) for \( j = \{S, N\} \); that is, both demand types prefer \( H \) to \( L \), ceteris paribus. In order to differentiate our two consumer types, we make two additional assumptions regarding appropriately scaled (comparable) utility of the quality sensitive and less quality sensitive types: (i) \( U(q^H, x) > U(q^L, x) \); (ii) \( U(q^H, x) > U(q^L, x) \). This second assumption simply asserts that a type \( S \) consumer values a high quality supplier more than a type \( L \) consumer and values abstention from a low quality supplier more than a type \( L \) consumer. As such, these assumptions simply define what it means to be sensitive or not as sensitive to quality. It follows that \( U(q^H, x) > U(q^L, x) \), which provides the crossing property of Figure 1.

**Information**

Buyers cannot determine quality with certainty but know with probability \( n \) that \( q \) is \( q^H \) (high quality) and with probability \( 1 - n \) that \( q \) is \( q^L \) (low quality).

**Budget Constraint**

\[ f(P, x) = Y, \]

where \( P \) is the unit price of prostitution services, the price of \( x \) is normalized to 1, and \( Y \) is exogenous income of the consumer. To avoid trivial cases we assume \( P < Y \).

**Optimization and Demand**

If \( \pi U(q^H, x) + (1 - \pi) U(q^L, x) > U(0, x = Y) \), then \( j \) consumers will demand prostitution services: \( D'(P; \pi, Y) > 0 \), \( x = (Y - P) > 0 \).

**Reservation Price Functions**

Let \( R' \) be the price at which \( \pi U(q^H, x) + (1 - \pi) U(q^L, x) = U(0, x = Y) \). For any price below this \( D' > 0 \), with \( D' = 0 \) else. We thus have distinct reservation price functions: \( R(\pi, Y) \) that are continuous in the probability \( \pi \). Moreover, by assumption (ii) in the utility section above these functions must cross in probabilities.

**Aggregation**

We assume there are an exogenously determined number of high and low quality types supplied; \( m^H, m^L \). Market demand in the high and low quality markets are simple step-functions at the respective reservation price, with total quantity demanded of \( n^H \) and \( n^L \) in each market below the reservation price.

**Producer Model**

Producers’ profit maximization “problem” is trivial given our assumption of an exogenously determined dichotomous non-transferable endowment (high quality \( H \) or low quality \( L \) that determines the opportunity wage \( \omega^H \) and \( \omega^L \), respectively). Given a large number of each type with free entry and exit, the reservation producer wage is \( \omega^H + \gamma^H \).

Appendix 2

**Proof of Proposition 1**

Consider each of the following cases in turn:

**Case 1:** \( R(\pi, Y) > P^H \) and \( n_S > m^H + m^L \). In this case there are sufficient high demand buyers \( (n_0) \) to buy services from all sellers at this high price: \( \pi = m^H/m^H + m^L \).

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16 Note that this implies nothing about the shape of the utility functions other than, ceteris paribus, that they generate demand functions for quality that cross in this fashion.
Case 2: $R(s, \pi, \delta) > p^H$ and $n_S < m^H + m^L$. There is excess supply at the high price. While high type sellers will not lower their price, since the high price represents their reservation price, only low types charging $p^H$ who fail to find a buyer will lower their price. Any price below $p^H$ reveals a seller’s type to be low, so the price must fall to $p^L$ for a buyer to buy. As quantity supplied falls (as type $L$ deviate) an equilibrium is reached. In this new equilibrium, some percentage of type $L$ sellers charge the low price, and a partial pooling equilibrium is sustained.

Case 3: $R(s, \pi, \delta) < p^H$. No demand exists for type $H$ buyers. Type $L$ sellers offer the low price and the market pools at $p^L$.

Proof of Proposition 2
Consider each of the following cases in turn:

Case 1: $R(s, \pi, \delta) \geq p^H$ and $n_S \geq m^H + m^L$. In this case there was a pooling equilibrium sustained at the high price. Cost lowering agents in a competitive market result in high quality sellers willing to sell at $p^{H^A} < p^H$. Demand will be sufficient to buy from all sellers, and pooling at the high price is maintained. Buyer surplus rises as the price falls. Assuming competition, the number of sellers will rise until entry is no longer profitable at the reservation market price.

Case 2: $R(s, \pi, \delta) \geq p^H$ and $n_S \leq m^H + m^L$. In this case there was a partial pooling equilibrium at $p^H$ with some type $L$ sellers offering the low price. As costs fall, the competitive market prices become $p^{H^A} < p^H$ and $p^{L^A} < p^L$. Buyer surplus rises and seller surplus remains at zero as prices reflect opportunity costs.

Case 3: $R(s, \pi, \delta) \leq p^{L^A} < p^H$. In this case the market was pooling at $p^H$ and now pools at $p^{L^A} < p^L$. Less quality sensitive buyer surplus rises, while quality sensitive buyers still remain out of the market.

Case 4: $p^{H^A} < R(s, \pi, \delta) = p^H$. Initially the market was pooling at the low price and quality sensitive buyers were shut out. As lower costs bring competitive prices down, in this case the high price falls enough to now support the high end market. Depending upon the number of each type of buyer and seller (cases 1 and 2 in Proposition 1), the market will either pool at the high price or partially pool at the high price. The details are omitted as they follow the same logic as described above.

Proof of Proposition 3
The market was in one of the three possible equilibria identified in Proposition 1. Cartel power raises the market price above competitive prices but not higher than the reservation prices of type $S$ and $L$ buyers. Surplus to sellers and agents rises, while surplus to buyers falls. New prices are $p^{H^C} > p^H > p^{L^C} > p^L$.

Proof of Proposition 4
Consider each of the three possible equilibria (from Proposition 1).

Case 1: The market pools at the high price and all sellers receive this price. When agents enter and eliminate the uncertainty regarding quality (i.e., $\pi = 1$), the reservation price of quality sensitive buyers rises to $R(s, \pi = 1, \delta)$, so that in a competitive market the price becomes $p^{H^C} > p^H$. If $R(s, \pi = 1, \delta) - p^{H^C} = R(s, \pi) - p^H$, then consumer surplus rises; buyers will purchase from those sellers who work with an agent and credibly reveal their type, and the new equilibrium price becomes $p^{H^C}$. If that condition fails, then agents are not supported and the original equilibrium is sustained. As such, when agents serve an information sharing role, consumer surplus is raised. High quality sellers are either unchanged or helped as perfect competition keeps prices at opportunity cost.

Case 2: The market partially pools at $p^H$ and some transactions occur at $p^L$. The high end market in this equilibrium works identically to case 1, and price rises to $p^{H^C}$ when buyer surplus rises. Note that when agents fail to raise surplus, they will not exist in equilibrium. Low end suppliers who had formerly been successful at selling to high demand buyers at $p^H$ are now forced out of this market, and their surplus falls. Type $L$ sellers who were originally selling at $p^H$ continue to do so and are unchanged. Type $L$ buyers are unaffected.

Case 3: The market pools at the low price. The high end market does not exist. In the absence of agents the high end market fails to exist because the reservation price of the high end buyer is not sufficient to support seller opportunity cost. If $R(s, \pi = 1, \delta) = p^{H^C}$ then the high end market is now supported, thus raising the surplus of high end buyers and sellers. The low end market is unaffected. If $R(s, \pi = 1, \delta) < p^{H^C}$ then the market continues to pool at the low price, and there is no welfare effect on either buyers or sellers.

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17 As type $L$ sellers deviate, $\pi$ may rise to $\pi' > \pi$. As $R(s', \pi')$ rises (but price is fixed competitively at $p^H$), quality sensitive buyers' surplus will rise. However, entry may occur such that the proportions of $q^H$ and $q^L$ in the pooling portion of the market represent those in the overall population. The results are robust either way; the only effect is a higher surplus for high demand buyers if this entry does not occur.
References


