

On the Coexistence of Smuggling and Trafficking in Migrants

Yuji Tamura

**No 730**

**WARWICK ECONOMIC RESEARCH PAPERS**

**DEPARTMENT OF ECONOMICS**

THE UNIVERSITY OF  
**WARWICK**

# On the Coexistence of Smuggling and Trafficking in Migrants

Yuji Tamura\*

Department of Economics, University of Warwick

First version: 11 April 2005

Updated: 20 June 2005

## Abstract

Akerlof's (1970) model of asymmetric information is adapted for the migrant smuggling market where smugglers differ in their capacities to exploit their clients in the destination. Migrants may gain a greater surplus when informationally disadvantaged than under symmetric information, which can be a source of the market's prosperity. We show a static equilibrium where both exploitative and non-exploitative smugglers are active is subject to adverse selection in the long run in an environment where migrants trust social networks and distrust exploitative smugglers. We predict the market may converge to a stable state where only exploitative smugglers are active due to the very information transmission through social networks that is commonly used to evade hiring exploitative smugglers. Exploitative and non-exploitative smugglers then coexist only temporarily. Policymakers are likely to face a dilemma of whether to reduce the exploitation of smuggled migrants or the availability of smuggling services, for there seems to be a trade-off between these.

**Key words:** irregular migration, migrant smuggling, migrant trafficking, adverse selection

**JEL classification:** F22, J61, D82, L15, K42

---

\***Email:** y.tamura@warwick.ac.uk **Acknowledgement:** This article is based on my PhD thesis at the university. I benefited from supervision by Ben Lockwood. I received useful suggestions from Masa Henmi, Joob Pattaranit and Jeff Round. All remaining errors are mine.

# 1 Introduction

The migrant smuggling market has features that are worth microeconomic analysis. First of all, there exists no legally enforceable contract between the providers and the consumers of illicit border crossing services. In addition, the consumption of such services requires a loss of the consumers' control over the assets they carry with them while travelling—their own bodies and labour. Smuggling agents increasingly gain power to control these assets against the wills of the owners once the provision of smuggling services is implemented. Nevertheless, this shift of the asset control that increases the vulnerability of the consumers vis-a-vis the service providers has not caused the migrant smuggling market to vanish because not all smugglers exercise the power they gain in order to exploit their clients to their advantage. Some smugglers have technology to utilise migrant labour, while others do not.

There has been little analysis of the migrant smuggling market in economics so far, even though smuggling and trafficking in migrants have recently become one of the major international concerns.<sup>1</sup> Friebel and Guriev (2004) theoretically examine the interaction between migrants and smuggling agents. In their model, not all potential migrants are able to pay for smuggling services upfront. A worker may therefore enter a debt contract with a smuggler if migrating and must then pay back the debt through work in the destination. The study shows, while stricter border enforcement discourages both financially constrained and unconstrained workers to migrate illegally, better detection in the formal employment sector not only discourages the illegal entry of the latter type but encourages that of the former, biasing the composition of illegal immigrants towards the poorer end. In their model, while smugglers face a risk that migrants may default debt repayments, migrants do not face a risk of being exploited by their smugglers.<sup>2</sup>

Dessy and Pallage (2003) theoretically argue the risk of child trafficking serves as a deterrent to parents who send their children to labour markets. The effort to reduce the incidence of child trafficking therefore increases the parental

---

<sup>1</sup>There are now a number of organisations campaigning against these illicit activities from perspectives of human right protection. They include International Organization for Migration ([www.iom.int](http://www.iom.int)), United Nations Office on Drugs and Crime ([www.unodc.org](http://www.unodc.org)), Coalition Against Trafficking in Women ([www.catwinternational.org](http://www.catwinternational.org)), Human Rights Watch ([hrw.org](http://hrw.org)), Polaris Project ([www.polarisproject.org](http://www.polarisproject.org)), terre des hommes' Stop Child Trafficking ([www.stopchildtrafficking.org](http://www.stopchildtrafficking.org)), Anti-Slavery International ([www.antislavery.org](http://www.antislavery.org)) and UNICEF UK ([www.endchildexploitation.org.uk](http://www.endchildexploitation.org.uk)). The terms, migrant smuggling and trafficking, are defined later in this introduction.

<sup>2</sup>Guzman, Haslag and Orrenius (2002) model migrant smuggling explicitly, but their analysis in a two-country dynamic general equilibrium framework treats smugglers as suppliers of cost-saving border crossing services, and migrants do not face a risk of exploitation. It belongs to the theoretical macroeconomic literature on illegal immigration and border enforcement that began with Ethier (1986), Djajić (1987) and Bond and Chen (1987) but does not attempt to provide microeconomic analysis of interactions between migrants and smugglers.

supply of child labour. Their analysis concentrates on the household utility maximisation with respect to the supply of child labour, and traffickers are not modelled explicitly. Dessy, Mbiekop and Pallage (2005) present a general equilibrium model with the producers who choose between the legal sector and child trafficking.<sup>3</sup> They emphasise the importance of demand for trafficked children in influencing the incidence of child trafficking. These two studies address the issue of abuse but children are treated as commodities and do not make any decision. Hence these do not cover the problem we examine in this paper.

Our objective is to provide the first microeconomic analysis of the migrant smuggling market where we allow the fact that smugglers gain control over their clients by smuggling them. In our model, each smuggler's decision on whether it exploits its clients after successful smuggling is endogenous in the workers' expectation of exploitation in the destination, and a weakened position of a migrant vis-a-vis the smuggler does not necessarily result in exploitation. This paper thus provides a solution to one of Väyrynen's (2003: 3) criticisms about economic approaches to migrant smuggling, ie, inadequate attention paid to exploitative aspects. We focus on the equilibrium proportion of exploitative smugglers as well as the number of active smuggling agents in the market. The more exploitative the market, the greater the welfare loss. Our analysis, however, implies there is a tradeoff between the number of active suppliers and the extent of exploitation: policymakers face a dilemma of whether to improve the welfare of smuggled migrants or to diminish the availability of smuggling services.

We adapt Akerlof's (1970) model of asymmetric information for the migrant smuggling market. We assume smugglers exogenously differ in their capacities to exploit their clients in the destination and make two decisions at a given smuggling fee: enter the market or not, and exploit or not if smuggling. The exploitation decision depends on the workers' expectation of exploitation in the destination which determines the smuggling fee. Note the way we endogenise the quality of a smuggling service is different from Kim (1985). In his model, the quality of a secondhand car depends on the level of maintenance by the owner, and car owners exogenously differ in their marginal utility gains from the car quality. A car owner chooses the level of maintenance and also decides whether she/he sells or keeps the car. In our paper, the exploitation decision of a smuggler depends on the fee that cannot be chosen by the smuggler when exploitation capacities are private information.

We find, when workers cannot distinguish between heterogeneous smugglers,

---

<sup>3</sup>They model a small open source country in the sense that the price per child sold abroad is exogenously given.

an adverse selection problem may arise: only exploitative smugglers provide border crossing services even though workers are willing to pay a higher fee to hire non-exploitative smugglers. However, we also show, if the equilibrium results in the full participation of all smuggling agents, the total surplus of smuggled migrants is higher under asymmetric than symmetric information even though the number of potential migrants far exceeds that of potential smuggling agents. As in Wilson (1980), multiple equilibria can arise depending on the distribution of exploitation capacities. In this case, the one associated with the highest smuggling fee always Pareto-dominates the other(s).

We subsequently examine the market equilibrium over time by incorporating a common finding from surveys of smuggled and trafficked migrants that the most common initial source of information about smuggling agents they hire is the social network—parents, relatives, friends and other acquaintances. Another feature of the migrant smuggling market is it is very difficult for workers to identify exploitative smugglers. Victims of trafficking may communicate what happened to them via family/social networks but are often afraid of pointing out who did it because of the fear of retaliation. Moreover, they may not communicate the incidence at all if the nature of work they were forced to do overseas, eg, prostitution, is likely to stigmatise themselves in their home communities.

We assume only those smugglers who did not exploit are identified by the information transmission through social networks. The incidence of trafficking is communicated, but workers cannot identify traffickers. Accordingly, the migrant smuggling market is segmented into two: one in which information is symmetric, and the other where it is asymmetric. As a result, with a constant flow of potential smuggling agents into the economy, identified non-exploitative smugglers charging the full information fee and unidentified exploitative and non-exploitative smugglers charging a lower fee coexist in transitional equilibrium. We show the informationally asymmetric part of the market becomes increasingly exploitative over time, which in turn biases the composition of new entries towards the more exploitative. In the long run, a new entry of non-exploitative smugglers ceases, and the equilibrium converges to a stable state characterised by adverse selection. Dynamics we employ in this paper is similar to Janssen and Karamychev (2002) and Janssen and Roy (2004) but with exogenous information transmission common to the migrant smuggling market.<sup>4</sup>

In the rest of this introduction, we explain our working definitions of migrant smuggling and trafficking in this paper. In section 2, we gather stylised facts about these activities. Section 3 presents a benchmark model where informa-

---

<sup>4</sup>Janssen and Karamychev (2002) generalise Janssen and Roy (2004) who use the uniform distribution of different qualities. Both studies deal with durable goods, and each seller can supply only once.

tion is symmetric between smugglers and migrants. In section 4, we assume different exploitation capacities are private information. Section 5 examines the dynamics of the market equilibrium under the above mentioned information transmission. Section 6 concludes with policy implications. All numbered figures appear at the end of the paper.

The terms, smuggling and trafficking, have been used interchangeably by some researchers and practitioners but with clear distinction by others. A lack of consensus on the use of the terms complicates the analysis of these activities.<sup>5</sup> However, recent effort to create legal instruments to fight against human smuggling and trafficking has given a clear distinction between these activities. In December 1998, the General Assembly of the United Nations established an ad hoc committee for the purpose of setting up its Convention against Transnational Organized Crime and supplementing protocols specific to human smuggling and trafficking. As a result, the Protocol against the Smuggling of Migrants (UN, 2000b) entered into force on 28 January 2004, while the Protocol to Prevent, Suppress and Punish Trafficking in Persons (UN, 2000a) did so earlier on the Christmas day of 2003.

In this paper, we closely follow these two protocols.<sup>6</sup> Our working definitions are that a *smuggler* (or non-exploitative smuggler) is an agent who provides illegal border crossing services without exploiting its clients in the post-smuggling period, while a *trafficker* (or exploitative smuggler) is an agent who also provides the same border crossing services but with exploitation after successful smuggling.<sup>7</sup> We define *exploitation* as that of labour of a smuggled client, and we ignore for the sake of economic analysis elements of intimidation and violence that are seemingly often involved in both trafficking and smuggling. These working definitions of ours will become clear when we describe our analytical framework in section 3.

## 2 Stylised facts

Several non-economic studies have made crude estimates of the scales of smuggling and trafficking in migrants, based on apprehension data, court cases, survey questionnaires, interviews and best guesses. Salt (2003: Table 20) gathers and compares such estimated figures and suggests the annual total number of either smuggled or trafficked migrants is approximately 4 million in the world

---

<sup>5</sup>Salt and Hogarth discuss this problem in Laczko and Thompson (2000: 18-23).

<sup>6</sup>See appendix 1 for the relevant excerpts from these UN protocols.

<sup>7</sup>Whether exploitation of migrants is involved or not is often taken as a distinguishing criterion between trafficking and smuggling, eg, Kelly and Regan (2000: 3), Salt (2000: 33-4) and Interpol ([www.interpol.int](http://www.interpol.int)).

in the second half of the 1990s. According to the US government (USDS, 2004: 23), approximately 600,000 to 800,000 persons were trafficked across international borders worldwide in 2003. Although these figures are not comparable, the incidence of trafficking appears to be lower than that of smuggling.<sup>8</sup>

This section does not provide a thorough collection of stylised facts about migrant smuggling and trafficking but only a selection of them that are relevant to our analysis.<sup>9</sup> Note, while increasingly available surveys of smuggled and trafficked migrants reveal the demand side of the market, its interaction with the supply side and the consequences, they do not inform us of much about the supply side, ie, smugglers and traffickers. Studies of smugglers and traffickers describe their characteristics and activities by referring to mass media reports or quoting what was told by police officers, crime investigators, immigration officers, charity personnel and smuggled and trafficked migrants, but hardly by smugglers and traffickers themselves. This implies that our knowledge of the supply side of the market is rather limited.

**Motives for migration** Existing surveys of smuggled migrants, victims of trafficking and the like indicate, although economic reasons are not the only factors that influence migration decision making, these seem to be the major factors.<sup>10</sup> They can be divided into two: economic hardship, such as unemployment and poverty, at home countries and better economic prospects at destination countries. The former is the so-called economic push, and the latter the economic pull.

Economic hardship was found to be the most common reason for migration among smuggled or trafficked migrants in Armenia (IOM, 2002a: 16), Georgia (IOM, 2001: 14), Ukraine (Uehling, 2004: 90-1) and Southeastern Europe (CTRCP, 2003).<sup>11</sup> In Azerbaijan, Bickley (2001: 27) found the same, but IOM (2002b: 16-7, 21) suggests both push and pull factors influence an individual's migration decision simultaneously. This is natural because, if economic prospects are not thought to be any better overseas than at home, there would not be an incentive to leave his/her country. However, there also seem to be those whose migration decisions are influenced purely by the economic pull. Pieke (2002: 32) and Chin (1999: 14, referred by Skeldon, 2000b: 17) found such individuals are more common in China. Lăzăroiu and Alexandru (2003:

---

<sup>8</sup>We should remain sceptical of these estimates, for the nature of both smuggling and trafficking in migrants is clandestine. However, the UK government (IND, 2001: 75) also expressed the same view that trafficking takes place less frequently than smuggling, concerning illegal immigration in the country. See also IOM (2002a) for Armenia and Budapest Group (1999: 15).

<sup>9</sup>Salt and Hogarth provide an empirical literature review in Laczko and Thompson (2000).

<sup>10</sup>Noneconomic reasons include civil wars, ethnic conflicts, political prosecutions, family/relationship problems at home, family reunions and desires for adventure.

<sup>11</sup>See also IOM (1996).

34-7) found females with higher aspiration are more vulnerable to trafficking in Romania, suggesting the economic pull is important.

In this paper, we take a traditional economic approach to migration decision making and assume the migration decision positively depends on the income gap between the origin and the destination. More specifically, we assume each worker can earn zero income at home, ie, no employment prospect at home, while she/he is employed with certainty at the destination.<sup>12</sup>

**Demand for smuggling services** A number of authors have argued restrictive immigration policies of destination countries increase the number of migrants who choose to resort to clandestine border crossing and smugglers who can organise it, eg, Ghosh (1998: 148), Budapest Group (1999: 15-6), Schloenhardt (1999: 212), Kelly and Regan (2000: 5), Skeldon (2000a), Andreas in Kyle and Koslowski (2001: 116), Cornelius (2001: 668), Marshall (2001), ILO (2002: 4), Gallagher (2002: 28), Taran and Chammartin (2003: 5-6), Väyrynen (2003: 3) and NCIS (2003: 37), although there is no firm statistical evidence to prove this.<sup>13</sup> Futo and Jundl (2004: 78, 151-2, 158) report recently apprehended illegal immigrants in Hungary, Turkey and Ukraine have increasingly relied on smugglers. The UK government (IND, 2001: 76) estimates smugglers and traffickers are involved in approximately 75 percent of detected cases of illegal border crossing. Koser's (2000: 102-3) survey found some asylum seekers in the sample turning to smugglers because of restrictive policies against them.<sup>14,15</sup>

However, a host country's government is unlikely to take a tolerant immigration policy because, while it may reduce the dependence of irregular migrants on smuggling agents and their vulnerability to traffickers, the number of illegal immigrants is likely to increase. For instance, according to the European Commission (2004: 9), the Belgian regularisation programme of 1999 that allowed illegal residents in the country to submit asylum applications seem to have encouraged illegal immigration subsequently.

---

<sup>12</sup>Accordingly, we will focus on migrants whose decisions are affected by both push and pull factors. Our analysis can be generalised by introducing a range of income levels at home among potential migrants.

<sup>13</sup>Donato, Durand and Massey (1992: 153) found weak evidence with a small sample, while Singer and Massey (1997: Table 4) found a significant positive relation between the number of US linewatch hours and the use of smugglers in Mexico. On the other hand, Gathmann (2004: Table 6b) found the direct effect of strengthened border enforcement on the demand for a smuggler is little.

<sup>14</sup>See Morrison and Crosland (2001: 27-39) who explain the restrictive nature of European immigration policies against asylum seekers.

<sup>15</sup>Another reason to hire a smuggler might be cost minimisation. Skeldon (2000a: 9-10) speculates that the use of smuggling services is often less costly than that of official channels because the latter involves a significant amount of time and bribes. However, bribery is rife in the process of both smuggling and trafficking, and hence its costs are likely to be included in smuggling fees.

In this paper, we simply assume individuals need to hire smugglers if they wish to migrate. We thus assume the host country has restrictive immigration policies so that migrating individuals cannot enter the destination legitimately. Our analysis is limited in the sense that migrants do not choose between illegal entries by themselves and entries arranged by smugglers.

**Information transmission** We have mentioned economic push and pull are the major reasons for migration. Note, while economic hardship is something that is actually experienced by potential migrants in home countries before migration, better economic prospects are not. Pull factors are based on migrants' expectations. That is, even if better economic prospects at destinations are real, there is no guarantee that migrants will have access to them after migration.<sup>16</sup>

Many of those who are planning to migrate, and first-time migrants in particular, gain information about destinations, jobs and also smugglers from family members, relatives, friends and acquaintances, eg, Frejka, Okólski and Sword (1999: 51) in Ukraine, IOM (2002a: 18) in Armenia, İçduygu (2003: 35, 46) in Turkey and UNICRI (2003: 48-9) in the Philippines. Social networks are useful for obtaining reliable information and lowering the risks involved in migration, such as apprehension by the border police and deception by the smuggler. Positive correlations between the availability of family/social networks and the decision to migrate might be interpreted by this reduction in implicit costs related to migration, eg, Espinosa and Massey (1997) and Orrenius (1999). In general, potential migrants in a community become better and better informed, over time, of costs and benefits involved in migration when the community regularly sends its members abroad, expanding its social networks, eg, Giza in Frejka, Okólski and Sword (1998: Chapter 7) in Poland. Singer and Massey's (1997: Table 4) empirical analysis shows a strong correlation between a migrant's chance of hiring a smuggler and the prevalence of experienced migrants in his community, which may suggest migrants with previous positive experiences with smugglers do share information with their community members.<sup>17</sup>

However, information transmission through social networks is likely to be lopsided: non-exploitative smugglers are more easily identified by potential migrants than traffickers. Victims of trafficking may communicate what happened to them via family/social networks but usually are afraid of pointing out who did it because of the fear of traffickers' reprisals against themselves and their

---

<sup>16</sup>This feature is modelled by Todaro (1969; 1970) and Harris and Todaro (1970) in the context of rural-urban migration under unemployment risk. Todaro and Maruszko (1987) adopt the same approach to illegal migration.

<sup>17</sup>This in turn implies that those who are not socially well connected are vulnerable to traffickers. IOM's (2001: 16-7) survey of victims of trafficking in Georgia found the majority of the sample could not rely on help and advice through social networks and had to look for smuggling agencies by themselves.

loved ones.<sup>18</sup> Moreover, exploited migrants often have bitter experiences that they would prefer not to share with others in their communities. For example, regardless of having been forced or voluntarily accepted, the fact that a migrant was a prostitute overseas would stigmatise the person in many cultural settings. As a result, trafficked victims of this type are likely to remain silent, eg, IOM (2001: 36).<sup>19</sup> In addition, even if the incidence of trafficking is well known, traffickers may hardly be identified by potential migrants because they would disappear from the community after successful trickery and abuses, eg., Frejka, Okólski and Sword (1999: 52) and IOM (2001: 16).

In section 5 where we examine the market equilibrium over time, we take into account this feature of information transmission. For simplicity, we assume that both exploited and unexploited migrants in one period communicate what happened to them in their community in the next period, but only smugglers who did not exploit their clients can be identified.

**Charge for smuggling services** Charges for smuggling services as well as payment methods vary widely, and known figures and methods are based on individual cases. Therefore, we do not list these here.<sup>20</sup> However, there appears to be a common observation in this market. Namely, non-exploitative smugglers charge their clients for border crossing services, while traffickers may or may not explicitly charge their prey for smuggling.<sup>21</sup> For instance, an IOM study of trafficked women in Belgium found, while most of them did not have to pay a fee to the traffickers, they found themselves indebted on arrival.<sup>22</sup>

Provided the exploitation of smuggled persons at the destination is sufficiently profitable, it is understandable that some traffickers need not charge them for border crossing. In addition, traffickers are better off pretending they are non-exploitative if migrants are capable of paying for smuggling services. In our model, traffickers can mimic the fee chargeable by non-exploitative smugglers because the reservation fee is lower for the former than the latter. Hence signalling is not available for the latter under asymmetric information.

We assume migrants pay the smuggling fee only after successful border crossing. Since there are cases where migrants must pay the smuggling fee upfront,

---

<sup>18</sup>Violence is frequently used to control victims, eg, Aronowitz (2001: 177).

<sup>19</sup>An IOM study in Poland (referred by Ghosh, 1998: 67) suggests migrants tend to pretend to be better off than they actually are, and failure abroad is not readily admitted.

<sup>20</sup>IOM (2003: Table 17.21) lists ranges of smuggling fees by origin and destination. See also Ghosh (1998: 31-2).

<sup>21</sup>Traffickers make an excuse when exploiting smuggled migrants that they became heavily indebted while being smuggled, so they charge for smuggling implicitly through exploitation. In this paper, we concentrate on commercial smugglers and do not deal with non-exploitative smugglers who do not charge migrants at all. An example is someone who assist an asylum seeker to cross a border on a humanitarian basis.

<sup>22</sup>Referred by Ghosh (1998: 22)

or where they pay it by instalments, our analysis is not comprehensive. In our model, migrants are rational: paying the fee upfront could give a smuggler an incentive to default on the provision of border crossing services, and the migrants should therefore condition the fee payment on successful smuggling. According to Donato, Durand and Massey (1992: 151) for Mexico, Içduygu and Toktas (2002: 38-9) for the Middle East and Futo and Jandl (2004: 18) for Central and Eastern Europe, it is not uncommon that the fee payment is made only after the client is smuggled as promised.

We also assume migrants are able to pay for the fee without being indebted to smugglers. Hence we do not examine the case where a migrant enters a debt contract with a smuggler.<sup>23</sup> This is analysed by Friebel and Guriev (2004) without allowing smugglers to exploit their clients.

**Exploitation** Migrants become vulnerable once they depart their countries of origin. They are often deprived of their true identities in the form of passport in order to enter the destination clandestinely. Subject to legal prosecution under the immigration laws of destination countries and devoid of financial means, smuggled migrants often find their freedom of movement severely curtailed, eg, IOM (2001: 32). Victims of trafficking often become aware that they are duped during their journeys or on arrival at the destination planned by traffickers. There are two ways of exploiting smuggled migrants. One is by using them directly, and the other by selling them.

The sex industry can illustrate the financial gain from the coercive use of smuggled migrants. Leskinen (2003) reports detailed figures from the seized bookkeeping of an exposed case in which 5 to 8 Estonian females were working as prostitutes in 5 apartments under a criminal leader of the same nationality with Finish pimps in Helsinki in 2001. A 20-minute visit to one of these apartments cost 300 markkaa, which are divided into 200 for the pimps and 100 for the female worker.<sup>24</sup> The bookkeeping showed the number of clients was about 1,000 per month, which implies the monthly revenue of 200,000 markkaa to the pimps. The estimated profit to the criminal group after deducting the costs of running the business was at least 100,000 markkaa per month, ie, almost 17,000 euros.<sup>25</sup>

Smugglers who are not employers of their clients can still exploit the migrants simply by selling them. Home Office (2004: 77) for example reports that the price of a Thai female sold to brothel organisers operating in the United King-

---

<sup>23</sup>A financially constrained person does not necessarily enter a debt contract with a smuggler to finance clandestine migration if there is an alternative source of credit such as family members' credit. See Genicot and Senesky (2004: Tables 4 and 5) for some empirical evidence.

<sup>24</sup>100 markkaa  $\simeq$  16.82 euros, according to the report.

<sup>25</sup>The extent of economic and sexual exploitation by coercive pimps might be similar among native and migrant prostitutes. See May, Harocopos and Hough (2000) for the British case.

dom was 6,000 pounds sterling in the case uncovered by Operation Horsley.<sup>26</sup> The money paid to the smugglers seem to become debts that the females are forced to repay. In such a case, they receive little money from their work, eg, Hughes (2000: 633-4).

Females managed by exploitative smugglers can be repeatedly traded during the smuggling process. IOM and ICMC's (2002: 7-10) report suggests, in Yugoslavia, the existence of trading houses was identified where females for exploitation were exhibited and purchased before border crossing, and higher prices seem to be paid to those who bring younger females to the market. Pobortscha (2002) suggests similar quasi-slave trading in Moldova, and Erder and Kaska (2003: 63) in Turkey.

In our model, exploitation is defined as the use of labour without remuneration, thus ignoring the case where trafficked migrants are sold in the destination. Smugglers are exogenously endowed with different exploitation capacities. As a result, not all smugglers exploit their clients, and traffickers exploit migrants at various levels, which appears realistic, eg, IOM (2001: 33-4).

### 3 Benchmark

We now set up a two-country model with a fixed number of identical workers and a fixed number of heterogeneous smugglers. All the workers legally reside in one of the two countries, and we call it the home. The other country is called the destination to which they may attempt to migrate. Economic prospects for the workers are better in the destination than in the home in the sense that the exogenously given earnings per unit of labour are higher in the former than in the latter.

We assume that a worker has no means to migrate from the home to the destination except hiring a smuggler. A smuggler is capable of delivering such a worker from the home to the destination. Migrants would pay for smuggling services only if border crossing were successful.<sup>27</sup>

Let us normalise the total measure of the smugglers to 1, and each of them has the capacity of supplying 1 unit of border crossing services without the loss of generality. That is, it can be hired by at most one worker. The total measure of the workers is  $m \gg 1$ . All the agents are risk-neutral.

Let  $\beta_j \in (0, 1)$  denote the given probability of apprehension at the border for  $j \in \{M, S\}$  where  $M$  denotes migrant and  $S$  smuggler. Let  $\lambda_j \in (0, 1)$  denote

<sup>26</sup>See Metropolitan Police (2003: 32) for the details of this police operation.

<sup>27</sup>With this payment method, a smuggler cannot have an incentive to default on the provision of smuggling services after receiving a fee, though it does not solve the incentive problem of exploitative smugglers.

that of apprehension inland. We distinguish between  $\beta$  and  $\lambda$ , for they usually differ from each other and  $\lambda < \beta$  in many countries.<sup>28</sup> It also becomes useful to distinguish between the probabilities for migrants and smugglers when we conduct comparative statics. We commonly observe  $\beta_M > \beta_S$  and  $\lambda_M > \lambda_S$  in the real world. Smugglers are often able to abandon their clients in order to evade capture. Also, for example, the driver might be apprehended at the border, but it is often difficult to uncover the whole operation and organisation.<sup>29</sup>

### 3.1 Smugglers

We assume a smuggler's decision to exploit its client depends on its capacity to do so which determines the profitability of exploitation. Exploitation of smuggled migrants in the destination requires relevant facilities to conduct illicit business, evade capture and restrict the freedom of the exploited. Criminal syndicates are likely to be well endowed with such facilities.

Smugglers exogenously differ in their capacities to exploit their smuggled clients in the destination. We define exploitation as the use of labour without remuneration. Let  $k \in [0, 1]$  denote the given capacity of a smuggler to exploit its migrated client's labour net of exploitation costs.

We suppose each worker is endowed with one unit of labour that can generate  $y > 0$  in the destination. Therefore, if exploitation takes place, the smuggler's gain per migrant is  $ky$  while the client's earnings are reduced from  $y$  to  $(1 - k)y$ .

Let  $\Phi(k)$  be a distribution function, and  $\phi(k) > 0 \forall k \in [0, 1]$  is the corresponding density function. Hence  $\Phi(\cdot)$  is nondegenerate.

Suppose a smuggling operation resulted in successful border crossing. The migrant had paid a smuggling fee,  $f$ . The smuggler's expected profit from the post-smuggling exploitation is

$$\tilde{\pi} = (1 - \lambda_S)ky - \lambda_S(f + p + kq) \quad (1)$$

where  $p > 0$  represents the fixed penalty for smuggling and  $q > 0$  the marginal penalty for exploitation in pecuniary terms. The expression assumes the fee payment by a client is seized and forfeited in the case of apprehension.<sup>30</sup> Note, the first term indicates, when exploitation takes place, the smuggled migrant

<sup>28</sup>See for instance Miller in Kyle and Koslowski (2001: Chapter 12).

<sup>29</sup>Aronowitz (2001: 169) notes forced prostitutes are likely to have more contacts with those other than traffickers than non-sexual forced labourers. In order to minimise the risk of apprehension, victims are often rotated geographically. Raviv and Andreani (2004) found human trafficking operations have become increasingly invisible in the Balkan region.

<sup>30</sup>This is equivalent to assuming the total penalty is increasing in the fee received. This innocent looking assumption is crucial when we endogenise the ratio between smugglers and traffickers.

and the smuggler are always caught together with the apprehension probability of  $\lambda_S$ . We thus assume  $k$  takes into account the capacity to reduce  $\lambda_M$  to zero.

Let  $e(k) \in \{0, 1\}$  be a binary variable that is 1 if a type- $k$  smuggler decides to exploit its client and 0 if it does not. We assume a smuggler exploits its client iff  $\hat{\pi}(k) > 0$ , ie,

$$e(k) = \begin{cases} 0 & \text{if } \hat{\pi}(k) \leq 0 \\ 1 & \text{otherwise.} \end{cases} \quad (2)$$

Since the success of border crossing is uncertain at the pre-smuggling stage, a smuggler's total expected profit from smuggling is

$$\hat{\pi} = (1 - \beta_S)(1 - \beta_M)(f + e\hat{\pi}) - \beta_S p - c \quad (3)$$

where  $c > 0$  denotes the sum of smuggling costs such as expenditures on transportation, hiding places, fraudulent documents and bribes. The first term implies a smuggler does not face a risk of apprehension inland if it decides not to exploit its client.<sup>31</sup> It also assumes a smuggler must deliver its client to the destination in order to receive the fee,  $f$ .

Let  $\bar{\pi} > 0$  denote the alternative profit available for each smuggler, and we assume  $\hat{\pi} > \bar{\pi}$  is both necessary and sufficient for it to supply border crossing services.

## 3.2 Workers

Each worker is endowed with one unit of labour which is supplied inelastically in either the home or the destination.<sup>32</sup> Let  $y > 0$  denote the earnings per unit of labour in the destination.<sup>33</sup> Let us normalise a worker's alternative income, ie, the earnings in the home, to zero. If apprehended, a worker is sent back to the home without paying neither a penalty nor a smuggling fee.<sup>34</sup>

<sup>31</sup>Commonly, apprehended illegal workers are not questioned for the purpose of tracing the smugglers and traffickers who brought them in.

<sup>32</sup>We thus ignore the case where a worker supplies a fraction of the labour endowment in the home and the rest in the destination.

<sup>33</sup>We ignore the possibility of smuggled migrants being unemployed in the destination because there appears to be high demand for illegal migrants who are usually willing to accept lower wages than natives. See OECD (2000: Chapter 3) for an overview. Profitability of hiring unauthorised migrants is exemplified by Ghosh (1998: 77): the convicted employers of irregular migrants in the Netherlands in 1991 made a significant financial gain even after paying for penalties and out-of-court settlements. Furthermore, Anderson and O'Connell Davidson (2003: 21, 25) found some features specific to migrants are preferred by consumers.

<sup>34</sup>This assumption may not be reasonable in some cases. Pacurar (2003) points out that, although migrants are not subject to criminal prosecution for being the object of smuggling, they can be prosecuted for holding fraudulent documents or/and directing the third party to smuggle themselves. We assume throughout the paper that migrants are not prosecuted but sent back to the home country without compensation for what the smuggler took from them.

Suppose each smuggler's  $k$  is known to the workers. Suppose (1), (2) and (3) are also known to them. The expected utility of a successfully smuggled worker at the post-smuggling stage is

$$\tilde{u} = (1 - \lambda_M)(1 - e\lambda_S)(1 - ek)y. \quad (4)$$

Note, when a migrant is exploited,  $\lambda_S$  has to be taken into account because there is no chance to expect  $(1 - \lambda_M)(1 - k)y$  if the smuggler and the migrant are caught during the exploitation process, ie,  $\lambda_S = 1$ . We thus assume if exploitation takes place it does before a migrant can make use of any labour being unused by the smuggler.

At the pre-migration stage, a worker's expected total utility from hiring a smuggler is

$$\hat{u} = (1 - \beta_M)(\tilde{u} - f) \quad (5)$$

which assumes the smuggling fee,  $f$ , is paid only if border crossing is successful. The expression also assumes a smuggler has the power to collect the promised smuggling fee once its client is smuggled successfully, regardless of whether the smuggler is caught at the border. We suppose workers are not wealth-constrained in financing assisted clandestine migration.

We assume  $\hat{u} \geq 0$  is both necessary and sufficient for a worker to hire a smuggler. (5) implies the following participation constraint under symmetric complete information:

$$f \leq (1 - \lambda_M)(1 - e\lambda_S)(1 - ek)y \quad (6)$$

which needs to be met if a worker decides to hire a type- $k$  smuggler.

### 3.3 Equilibrium

Under symmetric complete information, the workers know the exploitation capacity of each smuggler as well as its exploitation decision rule. Accordingly, (6) and  $m \gg 1$  imply there is a competitive equilibrium fee for each exploitation capacity, ie,

$$f(k) = (1 - e\lambda_S)(1 - ek)f^\circ \quad (7)$$

where  $f^\circ \equiv (1 - \lambda_M)y$ .

---

This seems to apply to most of the cases.

$f^\circ$  is the fee a worker is willing to pay for a non-exploitative smuggling service. By substituting (7) into (1) with  $e = 1$ , the exploitation condition,  $\tilde{\pi}(f(k), k) > 0$ , can be rewritten as follows:

$$k > \tilde{k} \equiv \frac{\lambda_S (1 - \lambda_S) f^\circ + \lambda_S p}{\lambda_S (1 - \lambda_S) f^\circ + (1 - \lambda_S) y - \lambda_S q} \quad (8)$$

Therefore, we can rewrite the exploitation decision rule (2) as follows:

$$e(k) = \begin{cases} 1 & \text{if } k > \tilde{k} \\ 0 & \text{otherwise} \end{cases} \quad (2')$$

If  $\tilde{k} \geq 1$ , or equivalently  $y \leq \frac{\lambda_S}{1 - \lambda_S} (p + q)$ , no smuggler would exploit its clients. All the smugglers are exploitative if  $\tilde{k} < 0$  or equivalently  $y < \frac{\lambda_S}{1 - \lambda_S} \left( \frac{q}{1 + \lambda_S(1 - \lambda_M)} \right)$ , ie, the denominator of  $\tilde{k}$  is negative. Accordingly, we need  $y > \frac{\lambda_S}{1 - \lambda_S} (p + q)$  to have  $\tilde{k} \in (0, 1)$ .

For those who cannot exploit smuggled migrants profitably, ie,  $k \leq \tilde{k}$ , the participation constraint,  $\hat{\pi}(k \leq \tilde{k}) > \bar{\pi}$ , can be rewritten as

$$f > \bar{f} \equiv \frac{\beta_S p + c + \bar{\pi}}{(1 - \beta_S)(1 - \beta_M)} \quad (9)$$

where  $\bar{f}$  is the non-exploitative smuggler's reservation fee at or below which it does not supply a smuggling service.

Exploitative smugglers with  $k > \tilde{k}$  may not participate in the market because (7) suggests, the more exploitative a smuggler, the lower the fee it can charge. Their participation constraint,  $\hat{\pi}(k > \tilde{k}) > \bar{\pi}$ , is equivalent to the following:

$$k > \hat{k} \equiv \frac{\bar{f} + \lambda_S p - (1 - \lambda_S)^2 f^\circ}{(1 - \lambda_S) y - \lambda_S q - (1 - \lambda_S)^2 f^\circ} \quad (10)$$

If  $\hat{k} \geq 1$ , or equivalently  $y \leq \frac{\lambda_S}{1 - \lambda_S} (p + q) + \frac{\bar{f}}{1 - \lambda_S}$ , no trafficker enters the market. All the traffickers are active if  $\hat{k} < 0$  or equivalently either (a) a combination of a negative numerator and a positive denominator in the expression for  $\hat{k}$ , ie,  $\bar{f} + \lambda_S p < (1 - \lambda_S)^2 f^\circ < (1 - \lambda_S) y - \lambda_S q$  or (b) that of a positive numerator and a negative denominator, ie,  $\bar{f} + \lambda_S p > (1 - \lambda_S)^2 f^\circ > (1 - \lambda_S) y - \lambda_S q$ . In order to have  $\hat{k} \in (0, 1)$ , we need either

$$(1 - \lambda_S) y - \lambda_S q > \bar{f} + \lambda_S p > (1 - \lambda_S)^2 f^\circ \quad (11)$$

or  $(1 - \lambda_S)^2 f^\circ > (1 - \lambda_S) y - \lambda_S q > \bar{f} + \lambda_S p$ . The former implies both the denominator and the numerator of  $\hat{k}$  are positive, while both are negative for the latter. Note  $(1 - \lambda_S) y - \lambda_S q > \bar{f} + \lambda_S p$  or equivalently  $y > \frac{\lambda_S}{1 - \lambda_S} (p + q) + \frac{\bar{f}}{1 - \lambda_S}$

guarantees  $\tilde{k} \in (0, 1)$ . Let us assume (11) holds throughout so as to examine the market with  $\hat{k}, \tilde{k} \in (0, 1)$ .

**Assumption 1**  $y > \frac{\bar{f} + \lambda_S(p+q)}{1-\lambda_S} > \frac{(1-\lambda_S)^2(1-\lambda_M)y + \lambda_S q}{1-\lambda_S}$  holds.

In addition to restricting the threshold exploitation capacities,  $\tilde{k}$  and  $\hat{k}$ , over the open interval  $(0, 1)$ , this assumption implies the following.

**Lemma 1** *There is at least a trafficker who provides a border crossing service even without receiving a smuggling fee under assumption 1.*

**Proof.** (1), (2) and (3) suggest a trafficker with  $k > \frac{\bar{f} + \lambda_S p}{(1-\lambda_S)y - \lambda_S q}$  is active even if  $f = 0$ . Since  $k \in [0, 1]$ , such a trafficker exists iff  $y > \frac{\bar{f} + \lambda_S(p+q)}{1-\lambda_S}$ , which is met by the first part of assumption 1. ■

As we mentioned in section 2, this is an important feature of the migrant smuggling market.

Note both threshold exploitation capacities,  $\tilde{k}$  and  $\hat{k}$ , are exogenous, as shown in (8) and (10). The relationship between  $\tilde{k}$  and  $\hat{k}$  is ambiguous without restrictions on the parameters in the expressions. We have the following three possible situations under assumption 1.

**Proposition 1** *The market equilibrium is characterised as follows under symmetric complete information and assumption 1:*

	(a)	(b)	(c)
Environment	$\gamma \bar{f} < f^\circ$	$\bar{f} < f^\circ \leq \gamma \bar{f}$	$f^\circ \leq \bar{f}$
Nonexploitative smugglers	$\Phi(\tilde{k})$	$\Phi(\tilde{k})$	0
Exploitative smugglers	$1 - \Phi(\tilde{k})$	$1 - \Phi(\hat{k})$	$1 - \Phi(\hat{k})$
Inactive smugglers	0	$\Phi(\hat{k}) - \Phi(\tilde{k})$	$\Phi(\hat{k})$

where  $\gamma$  is a constant greater than unity.

**Proof.** (7) and (9) imply all the non-exploitative smugglers participate in the market iff  $f^\circ > \bar{f}$ . (8) and (10) suggest all the exploitative smugglers participate in the market iff  $\tilde{k} > \hat{k} \Leftrightarrow f^\circ > \gamma \bar{f}$  where  $\gamma \equiv \frac{\lambda_S(1-\lambda_S)(1-\lambda_M)y + (1-\lambda_S)y - \lambda_S q}{(1-\lambda_S)[(1-\lambda_S)y - \lambda_S(p+q)]} > 1$  under assumption 1. When  $\tilde{k} \leq \hat{k}$ , there are  $\Phi(\hat{k}) - \Phi(\tilde{k})$  smugglers who can exploit migrants profitably in the destination but do not participate in the market, for the cost of smuggling is too high, ie,  $\hat{\pi}(k > \tilde{k}) \leq \bar{\pi} \forall k \in (\tilde{k}, \hat{k}]$ . ■

In case (a), every smuggling agent supplies a border crossing service. In case (b), there are  $\Phi(\hat{k}) - \Phi(\tilde{k})$  agents who can exploit their smuggled clients profitably, which negatively affects the overall profit via a reduction in their fees under symmetric complete information so that they decide not to supply border crossing services. As a result, “modestly exploitative” smugglers, ie,  $k \in (\tilde{k}, \hat{k}]$ , do not operate. Active smugglers are either non-exploitative, ie,  $k \in [0, \tilde{k}]$ , or “highly exploitative”, ie,  $k \in (\hat{k}, 1]$ .

In case (c), not only “modestly exploitative” but also non-exploitative smugglers do not supply border crossing services. However, “highly exploitative” smugglers continue to operate, for they can profit from post-smuggling exploitation sufficiently enough to offset their low smuggling fees. Note, under symmetric complete information, any of these outcomes is Pareto-efficient, and each worker pays according to the observable exploitation capacity of each smuggler.

## 4 Asymmetric information

Let us now suppose the exploitation capacity of each smuggler is private information. Potential migrants are then unable to distinguish between the smugglers with different exploitation capacities. Accordingly, the smuggling fee is determined independently of the smuggler of any particular type whom they hire. Because the workers are identical, every one of them forms the same expectation of exploitation in (7), ie, there is a single smuggling fee in the market. Let  $f$  be a function of the expected exploitation capacity denoted by  $\kappa$ . In the previous section, we saw the threshold exploitation capacities,  $\tilde{k}$  and  $\hat{k}$ , were exogenously determined under symmetric information. In this section, we endogenise these in the expected exploitation via the smuggling fee,  $f(\kappa)$ .

The exploitation condition,  $\tilde{\pi}(f(\kappa), k) > 0$ , can be rewritten as

$$f(\kappa) < \tilde{f}(k) \equiv \left( \frac{1 - \lambda_S}{\lambda_S} y - q \right) k - p. \quad (12)$$

The exploitation decision of a smuggler thus depends on its  $k$ . If  $y > \frac{\lambda_S}{1 - \lambda_S} q$ , smugglers with higher exploitation capacities are more likely to decide to exploit their clients. This is the case under assumption 1.

Those with  $k$  at which  $\tilde{f}(k) \leq f(\kappa)$  are non-exploitative and enter the market iff  $f(\kappa) > \bar{f}$ , as shown in (9). That is, the participation decision of a non-exploitative smuggler does not depend on its own type.

Those with  $k$  at which  $\tilde{f}(k) > f(\kappa)$  are exploitative and enter the market

iff  $\hat{\pi}(f(\kappa), k) > \bar{\pi}$  which can be rewritten as

$$f(\kappa) > \hat{f}(k) \equiv \frac{\bar{f} + \lambda_S p}{1 - \lambda_S} - \left( y - \frac{\lambda_S}{1 - \lambda_S} q \right) k. \quad (13)$$

It shows the participation decision of an exploitative smuggler depends on its  $k$ . If  $y > \frac{\lambda_S}{1 - \lambda_S} q$ , more exploitative smugglers have lower reservation fees because of higher expected gains from exploitation in the post-smuggling period. Again, this is the case under assumption 1. In addition, by lemma 1, we know there is at least a trafficker who is active but need not charge a fee.

**Lemma 2** *Non-exploitative smugglers cannot use a different fee to distinguish themselves from exploitative smugglers under assumption 1.*

**Proof.** Assumption 1 suggests  $d\hat{f}/dk < 0$  in (13), while the non-exploitative smuggler's reservation fee is fixed at  $\bar{f}$  in (9). There exists at least a trafficker for whom  $\hat{f} < \bar{f}$  because  $\hat{f} < \bar{f} \Leftrightarrow k > \frac{\lambda_S(\bar{f} + p)}{(1 - \lambda_S)y - \lambda_S q} \in (0, 1)$  under assumption 1, implying non-exploitative smugglers cannot use a lower-than-the-market fee for signalling. Since (1), (2) and (3) indicate  $d\hat{\pi}(\hat{\pi} > 0)/df > 0$ , neither can a higher-than-the-market price be used for signalling. ■

This suggests there always are exploitative smugglers who are willing to mimic any fee that non-exploitative smugglers might charge. Hence rational workers should ignore any fee signalling by non-exploitative smugglers.

Expressions (12) and (13) can be rewritten in a way analogous to (8) and (10) as follows:

$$k > \tilde{k}' \equiv \frac{\lambda_S f(\kappa) + \lambda_S p}{(1 - \lambda_S)y - \lambda_S q} \quad (14)$$

and

$$k > \hat{k}' \equiv \frac{\bar{f} + \lambda_S p - (1 - \lambda_S)f(\kappa)}{(1 - \lambda_S)y - \lambda_S q} \quad (15)$$

Notice, while  $\tilde{k}$  and  $\hat{k}$  are exogenously given in (8) and (10) under symmetric information,  $\tilde{k}'$  and  $\hat{k}'$  are dependent on the workers' expectation,  $\kappa$ , via the market fee. Expressions (14) and (15) suggest

$$\bar{f} < f(\kappa) \Leftrightarrow \hat{k}'(\kappa) < \tilde{k}'(\kappa) \quad (16)$$

which leads to the following lemma.

**Lemma 3** *The total number of active smuggling agents is non-decreasing in the fee, and the average exploitation is strictly decreasing in it.*

**Proof.** (i) If  $f > \bar{f}$ , (9) suggests all non-exploitative smugglers are active. (16) suggests all traffickers are also active. Hence the number of active suppliers totals to measure one. If  $f \leq \bar{f}$ , all non-exploitative smugglers are inactive. There are  $1 - \Phi(\hat{k}')$  active traffickers where (15) suggests  $\partial \hat{k}' / \partial f < 0$ . (ii) If  $f > \bar{f}$ , the average exploitation capacity is  $\int_{\tilde{k}'}^1 k \phi(k) dk$  where (14) suggests  $\partial \tilde{k}' / \partial f > 0$ . If  $f \leq \bar{f}$ , it is  $(1 - \Phi(\hat{k}'))^{-1} \int_{\tilde{k}'}^1 k \phi(k) dk$ . By differentiating it with respect to  $f$ , we obtain  $(\partial \hat{k}' / \partial f)[(1 - \Phi(\hat{k}'))^{-1} \int_{\tilde{k}'}^1 k \phi(k) dk - \hat{k}' \phi(\hat{k}') / (1 - \Phi(\hat{k}'))] < 0$ . ■

The following table summarises the two possible situations:

	(a)	(b)
Environment	$\bar{f} < f(\kappa)$	$f(\kappa) \leq \bar{f}$
Nonexploitative smugglers	$\Phi(\tilde{k}')$	0
Exploitative smugglers	$1 - \Phi(\tilde{k}')$	$1 - \Phi(\hat{k}')$
Inactive smugglers	0	$\Phi(\hat{k}')$

Compared to the table in proposition 1, there is no case where some traffickers are inactive while non-exploitative smugglers are active. Such a case was a possibility in the previous section because reservation fees of “modestly exploitative” traffickers might be higher than non-exploitative smugglers’ under symmetric information.

Let us now analyse ceteris paribus effects of changes in policy instruments.

**Proposition 2** *Suppose assumption 1 holds throughout.*

(i) *Improved border apprehension, whether  $\beta_M$  or  $\beta_S$ , decreases the number of active smuggling agents and increases the average exploitation if  $f \leq \bar{f}$ . If  $f > \bar{f}$ , it affects neither the number of smuggling agents nor the average exploitation.*

(ii) *Improved inland apprehension of migrants,  $\lambda_M$ , decreases the number of active smuggling agents and increases the average exploitation.*

(iii) *Improved inland apprehension of traffickers,  $\lambda_S$ , decreases the number of active smuggling agents and increases the average exploitation if  $f \leq \bar{f}$ . If  $f > \bar{f}$ , the opposite can happen iff  $\frac{\lambda_S}{1-\lambda_S} q > \{1 - [(1 - \lambda_S)(1 - \lambda_M) + \tilde{k}' / (1 - E[k|k \in K])]\tilde{k}' \phi(\tilde{k}')\} y - (p + q\tilde{k}')\tilde{k}' \phi(\tilde{k}') / (1 - E[k|k \in K])$ .*

(iv) *An increased penalty for migrant smuggling,  $p$ , decreases the number of active smuggling agents and increases the average exploitation if  $f \leq \bar{f}$ . If  $f > \bar{f}$ , the opposite happens iff  $\frac{\lambda_S}{1-\lambda_S} q > [1 - \frac{\beta_S + (1-\beta_S)(1-\beta_M)}{\beta_S} \lambda_S (1 - \lambda_M) \tilde{k}' \phi(\tilde{k}')] y$ .*

(v) An increased marginal penalty for exploitation,  $q$ , increases the number of active smuggling agents and decreases the average exploitation iff  $\frac{\lambda_S}{1-\lambda_S}q > [1 - (1 - \lambda_S)(1 - \lambda_M)(E[k|k \in K] - \hat{k}')\phi(\hat{k}')/(1 - \Phi(\hat{k}'))]y$  if  $f \leq \bar{f}$ . If  $f > \bar{f}$ , the same happens iff  $\frac{\lambda_S}{1-\lambda_S}q < [1 - \lambda_S(1 - \lambda_M)\tilde{k}'\phi(\tilde{k}')]y$ .

**Proof.** See appendix 2. ■

As we can see in (9) and (15), border apprehension effort influences the market via the non-exploitative smuggler's reservation fee,  $\bar{f}$ . Since (14) shows these do not affect  $\tilde{k}'$ , they change neither the number of smuggling agents nor the average exploitation in the market as far as there are non-exploitative smugglers operating in the market, ie,  $f > \bar{f}$ . This is part (i) of the proposition.

Effort to apprehend migrants inland influences the market via the fee, as (17') shows. When it reduce the fee,  $\tilde{k}'$  falls and  $\hat{k}'$  rises, as (14) and (15) suggest respectively. When  $f > \bar{f}$ , the former increases the proportion of traffickers without changing the total number of active smuggling agents. When  $f \leq \bar{f}$ , the latter increases the average exploitation by requiring smugglers to be more exploitative in order to remain active. This is part (ii) of the proposition.

Parts (iii) to (v) suggest the other instruments can also be counter-productive if the priority is to prevent migrant exploitation from taking place. Lemma 3 and proposition 2 imply the following.

**Corollary 1** *A government might be able to reduce the size of the market, which inevitably increases the average exploitation.*

We can also compare the two possible situations in the table above with their informationally symmetric counterparts in proposition 1 in terms of the surplus of migrants. Under symmetric information, the surplus of migrants is zero, as (7) implies.

**Proposition 3** *Migrants are better off as a whole under asymmetric than symmetric information as far as there is an active non-exploitative smuggler.*

**Proof.** (a) Let  $W$  denote the surplus of served migrants. When  $f(\kappa) > \bar{f}$ ,  $W = (f^\circ - f(\kappa))\Phi(\tilde{k}') + \int_{\tilde{k}'}^1 (f(k) - f(\kappa))\phi(k)dk$  where the first term is of migrants who hire non-exploitative smugglers while the second is of those who hire traffickers. By simplification,  $W = \lambda_S f^\circ \Phi(\tilde{k}') > 0$ . (b) When  $f(\kappa) \leq \bar{f}$ ,  $W = \int_{\tilde{k}'}^1 (f(k) - f(\kappa))\phi(k)dk = 0$ . ■

In case (a) where non-exploitative smugglers are active, the first term of  $W$  is positive while the second is negative. The surplus gain to migrants who hire non-exploitative smugglers arises at the expense of a corresponding loss to those who hire traffickers. Since  $W > 0$ , the gain more than offsets the loss in the market. In case (b) where all active smugglers are exploitative,  $W = 0$ , ie, gains of some migrants and losses of the others completely offset each other. Proposition 3 implies migrants have a chance to gain when they are informationally disadvantaged as far as there is an active non-exploitative smuggler in the market. Note this gain arises even though the market is characterised by excess demand, ie,  $m \gg 1$ .

Let us now characterise the market equilibrium. The set of exploitation capacities of the smugglers who are willing to participate in the market at a given fee is

$$K(f) = \left\{ k : \begin{array}{ll} \bar{f} < f & \text{for } k \leq \tilde{k}'(f) \\ \hat{f}(k) < f & \text{otherwise.} \end{array} \right\} \quad (18')$$

Since every worker believes the average exploitation capacity in the market is  $\kappa$ , (6) and  $m \gg 1$  suggest each smuggler can charge for a clandestine border crossing service

$$f(\kappa) = (1 - \lambda_S)(1 - \kappa)f^\circ. \quad (17')$$

Note, as shown in the table above, there is no environment where only non-exploitative smugglers are active in the market. Therefore,  $\kappa > 0$ , and hence  $-\lambda_S$  is present in (17').<sup>35</sup>

As in standard adverse selection models, we define the equilibrium as the situation where the workers' expectation of the average exploitation capacity equals the actual average.<sup>36</sup> That is, we assume all the agents in the market know the distribution of the  $k$  parameter among the smugglers, and hence the workers' beliefs correctly reflect the actual average exploitation capacity of the smugglers who are active in the market. Accordingly,  $\kappa = E[k|k \in K]$ .

**Definition 1** Under asymmetric complete information, an equilibrium is characterised by a pair of a smuggling fee,  $f^*$ , and a set,  $K^*$ , of exploitation capacities being present in the market such that

$$f^* = (1 - \lambda_S)f^\circ(1 - E[k|k \in K^*]) \quad (17)$$

---

<sup>35</sup>For simplicity, we do not discount  $-\lambda_S$  by the ratio between traffickers and smugglers.

<sup>36</sup>See for instance Mas-Colell, Whinston and Green (1995: 439).

and

$$K^* = \left\{ k : \begin{array}{ll} \bar{f} < f^* & \text{for } k \leq \tilde{k}^* \\ \hat{f}(k) < f^* & \text{otherwise} \end{array} \right\} \quad (18)$$

where  $\tilde{k}^* \equiv \tilde{k}'(f^*)$  and, with  $\hat{k}^* \equiv \hat{k}'(f^*)$ ,

$$E[k|k \in K^*] = \begin{cases} \left( \int_0^1 k\phi(k) dk - \int_0^{\tilde{k}^*} k\phi(k) dk \right) & \text{if } f^* > \bar{f} \\ \left( \int_0^1 k\phi(k) dk - \int_0^{\hat{k}^*} k\phi(k) dk \right) \left( 1 - \Phi(\hat{k}^*) \right)^{-1} & \text{otherwise.} \end{cases} \quad (19)$$

[FIGURE 1 HERE]

It depends on  $\Phi(k)$  whether  $f^* > \bar{f}$  or not. Suppose  $f^* > \bar{f}$ . All smugglers are then active. This case is illustrated in figure 1. The downward slope of the expected fee schedule is steeper after a drop in the middle. This is because the drop represents the exit of all non-exploitative smugglers from the market. That is, the drop takes place where  $k = \tilde{k}' = \hat{k}'$ , as implied by (16).

On the other hand, if  $f^* \leq \bar{f}$ , all non-exploitative smugglers and “modestly exploitative” smugglers, ie,  $k \in (\tilde{k}^*, \hat{k}^*]$ , do not operate, and only traffickers with  $k \in (\hat{k}^*, 1]$  remain active. This suggests an equilibrium might be of adverse selection where all non-exploitative smugglers are driven out of the market.

**Proposition 4** *Under asymmetric complete information and assumption 1, if  $f^* \leq \bar{f}$ , the market equilibrium is characterised by adverse selection: only traffickers are active even though each worker is willing to pay  $f^\circ > \bar{f}$  to a non-exploitative smuggler.*

**Proof.** (9) implies all non-exploitative smugglers are inactive iff  $f^* \leq \bar{f}$ . (16) and (15) indicate traffickers with  $k > \hat{k}^*$  are active regardless of  $f^*$ . By lemma 1, such traffickers exist. ■

The equilibrium is not necessarily unique, as in Wilson (1980). The multiplicity depends on  $\Phi(k)$ . Figure 2 illustrates an example of multiple equilibria.

**Proposition 5 (Wilson, 1980)** *If there are more than one value for  $f^*$ , the highest is superior to the other(s) in the sense that (i) it results in the lowest average exploitation capacity and (ii) migrants' surplus is positive and the greatest if it exceeds  $\bar{f}$ .*

**Proof.** (i) (19) implies  $dE[k|k \in K^*]/df^* < 0$ . (ii) See proposition 3. ■

[FIGURE 2 HERE]

We have assumed that the reservation incomes of all the smugglers are identical, ie, the condition for exploitation is  $\tilde{\pi}(k) > 0$  and that for entering the market is  $\hat{\pi}(k) > \bar{\pi}$  for all  $k \in [0, 1]$ . As (14) shows, the exploitation decision depends on  $k$ . If a smuggler decides to exploit, (15) suggests its participation decision also depends on its  $k$ . However, the operation decision of those smugglers who decide not to exploit is independent of their  $k$  because their reservation fee is fixed at  $\bar{f}$  as in (9). If we make this dependent on  $k$ , eg,  $\bar{\pi}(k)$  with  $d\bar{\pi}/dk < 0$ , the sudden drop of the thick line in figures 1 and 2 is smoothed, for the participation decision of non-exploitative smugglers then varies according to their exploitation capacities.

Rose (1993) argued multiple equilibria are rare possibilities in Wilson's (1980) model of adverse selection. In the following section, we therefore focus on the environment where a static equilibrium is unique.

## 5 Over time

Our static analysis showed a market equilibrium requires either the full participation of both smugglers and traffickers or the participation of only traffickers. Over time, however, the static equilibrium ratio between smugglers and traffickers is not necessarily stable. The reason is that the informational structure is likely to change when the experiences of migrants can be communicated only imperfectly to workers who intend to hire smugglers. Potential migrants often gather information about reliable smugglers via social networks that they trust very much, but traffickers usually know how to remain unidentifiable in the market.

Consider overlapping generations of smuggling agents over the discrete time horizon  $t = 0, 1, 2, \dots, \infty$ . Suppose each of them operates only for two consecutive periods. In every period, a cohort of potential smuggling agents arises in the economy, totalling to measure one. The distribution of exogenous exploitation capacities in each cohort is time-invariable, ie,  $\Phi(k)$ . Let  $\delta \in [0, 1]$

represent the time-invariable impatience parameter common to all smugglers:  $\delta = 0$  implies smugglers are completely impatient. In period 0, the first cohort of smuggling agents arises in the economy, and none of the workers is informed of the exploitation capacity of any particular smuggler at the pre-smuggling stage.<sup>37</sup> We call a smuggler who arises in the economy in period  $t$  a period- $t$  smuggler.

If social networks are so efficient that  $k$  of all period- $t$  smuggling agents can be known to all potential migrants in period  $t + 1$ , the migrant smuggling market consists of two parts from period 1 onwards: one with period- $t$  agents under symmetric information and the other with period- $t + 1$  agents under asymmetric information. In this case, for all  $t = 1, 2, \dots, \infty$ , the symmetric part's equilibrium is characterised by proposition 1, and the asymmetric part's by definition 1. In period 0, the whole market is informationally asymmetric, and the equilibrium is characterised by definition 1. The equilibrium fees in the market are stable over time because we assume the distribution of exploitation capacities is fixed.

Let us now assume social networks are so trusted that smugglers who do not exploit their clients in period  $t$  can charge  $f^\circ$ , the maximum fee a worker is willing to pay a non-exploitative smuggler, in period  $t + 1$ . This may generate an incentive for some smugglers to refrain from exploiting their clients initially even though their exploitation capacities are high enough to have  $\tilde{\pi}(k) > 0$ . For simplicity, let us also assume potential migrants do not trust traffickers at all: a period- $t$  trafficker cannot charge a client  $f(k)$  by allowing its  $k$  to be known in period  $t + 1$ . A period- $t$  trafficker then must belong to the informationally asymmetric part of the market during its two consecutive periods.<sup>38</sup> Information transmission is thus imperfect.

## 5.1 Deception via social networks

Given the trust in social networks and the distrust in traffickers, we show a worker could hire a trafficker while he/she thinks it is a non-exploitative smuggler. Suppose a smuggling agent is active during its two consecutive service periods, ie,  $f_t^*, f_{t+1}^* > \bar{f}$ . There are then four possible operations: EN, EE, NN and NE where, for example, EN means 'exploit in the first period and do not exploit in the second.' In the first period, it can charge  $f_t^*$  regardless of

<sup>37</sup>For example, we can imagine a sudden increase in the number of potential migrants who cannot obtain information about migration via their social networks, eg, immediately after the collapse of the Soviet Union (Hughes, 2000).

<sup>38</sup>Alternatively, we can assume potential migrants seek only non-exploitative smuggling services. Without this assumption, we need allow period- $t$  traffickers to choose between  $f(k)$  and  $f_{t+1}^*$ , which significantly complicates the determination of the rational workers' expectation of exploitation.

its service. In the second period, it can charge  $f_{t+1}^*$  if it exploits in the first period but  $f^\circ$  if it does not exploit in that period. The following table presents the expected profit,  $\Pi$ , for each operation, where  $D \equiv (1 - \beta_S)(1 - \beta_M)$  and  $C \equiv \beta_S + c$ .

OPERATION	PERIOD	$\Pi$
EN	1st	$[f_t^* + (1 - \lambda_S) yk - \lambda_S (f_t^* + p + qk)] D - C$
	2nd	$+ \{f_{t+1}^* D - C\} \delta$
EE	1st	$[f_t^* + (1 - \lambda_S) yk - \lambda_S (f_t^* + p + qk)] D - C$
	2nd	$+ \{[f_{t+1}^* + (1 - \lambda_S) yk - \lambda_S (f_{t+1}^* + p + qk)] D - C\} \delta$
NN	1st	$f_t^* D - C$
	2nd	$+ \{f^\circ D - C\} \delta$
NE	1st	$f_t^* D - C$
	2nd	$+ \{[f^\circ + (1 - \lambda_S) yk - \lambda_S (f^\circ + p + qk)] D - C\} \delta$

Let us first look at the second-period exploitation decision making. Suppose a smuggler exploited in the first period. It can then charge  $f_{t+1}^*$  and exploits in the second period iff  $\Pi^{EE} > \Pi^{EN}$  or equivalently  $k > \tilde{k}_{t+1}^*$ . Suppose a smuggler did not exploit in the first period. It can then charge  $f^\circ$  and exploits in the second period iff  $\Pi^{NE} > \Pi^{NN}$  or equivalently  $k > \tilde{k}^\circ \equiv \lambda_S (f^\circ + p) / [(1 - \lambda_S) y - \lambda_S q]$ .

Since  $f^\circ > f_{t+1}^*$ , we have (a) those with  $k \in [0, \tilde{k}_{t+1}^*]$  who do not exploit in the second period regardless of their first-period exploitation decision, (b) those with  $k \in (\tilde{k}_{t+1}^*, \tilde{k}^\circ]$  who exploit iff they exploit in the first period and (c) those with  $k \in (\tilde{k}^\circ, 1]$  who exploit regardless of their first-period exploitation decision, assuming  $\tilde{k}^\circ < 1$ . Given these three groups, we can now examine the first-period exploitation decision making.

Those in group (a) exploit in the first period iff  $\Pi^{EN} > \Pi^{NN}$  or equivalently

$$k > \frac{(f^\circ - f_{t+1}^*) \delta + \lambda_S (f_t^* + p)}{(1 - \lambda_S) y - \lambda_S q}.$$

Such a smuggler exists iff  $\tilde{k}_{t+1}^* > \frac{(f^\circ - f_{t+1}^*) \delta + \lambda_S (f_t^* + p)}{(1 - \lambda_S) y - \lambda_S q}$  which is equivalent to  $(f_{t+1}^* - f_t^*) \lambda_S > (f^\circ - f_{t+1}^*) \delta$ .

Those in group (b) exploit in the first period iff  $\Pi^{EE} > \Pi^{NN}$  or equivalently

$$k > \frac{[f^\circ - (1 - \lambda_S) f_{t+1}^*] \frac{\delta}{1 + \delta} + \lambda_S \left( f_t^* \frac{1}{1 + \delta} + p \right)}{(1 - \lambda_S) y - \lambda_S q}.$$

Such a smuggler exists iff  $\tilde{k}^\circ > \frac{[f^\circ - (1 - \lambda_S) f_{t+1}^*] \frac{\delta}{1 + \delta} + \lambda_S \left( f_t^* \frac{1}{1 + \delta} + p \right)}{(1 - \lambda_S) y - \lambda_S q}$  or equivalently  $(f^\circ - f_t^*) \frac{\lambda_S}{1 - \lambda_S} > (f^\circ - f_{t+1}^*) \delta$ .

Those in group (c) exploit in the first period iff  $\Pi^{\text{EE}} > \Pi^{\text{NE}}$  or equivalently

$$k > \frac{(1 - \lambda_S)(f^\circ - f_{t+1}^*)\delta + \lambda_S(f_t^* + p)}{(1 - \lambda_S)y - \lambda_S q}.$$

Such a smuggler exists iff  $1 > \frac{(1 - \lambda_S)(f^\circ - f_{t+1}^*)\delta + \lambda_S(f_t^* + p)}{(1 - \lambda_S)y - \lambda_S q}$  or equivalently  $y - (f_t^* + p + q)\frac{\lambda_S}{1 - \lambda_S} > (f^\circ - f_{t+1}^*)\delta$ .

The following table summarises the conditions regarding the first-period exploitation we derived above by the three groups.

$k$	A TRAFFICKER EXISTS IF	ALL ARE TRAFFICKERS IF
$[0, \tilde{k}_{t+1}^*]$	$(f_{t+1}^* - f_t^*)\lambda_S > (f^\circ - f_{t+1}^*)\delta$	N.A.
$(\tilde{k}_{t+1}^*, \tilde{k}^\circ]$	$(f^\circ - f_t^*)\frac{\lambda_S}{1 - \lambda_S} > (f^\circ - f_{t+1}^*)\delta$	$(f_{t+1}^* - f_t^*)\lambda_S \geq (f^\circ - f_{t+1}^*)\delta$
$(\tilde{k}^\circ, 1]$	$y - (f_t^* + p + q)\frac{\lambda_S}{1 - \lambda_S} > (f^\circ - f_{t+1}^*)\delta$	$(f^\circ - f_t^*)\frac{\lambda_S}{1 - \lambda_S} \geq (f^\circ - f_{t+1}^*)\delta$

The last row of this table suggests there are those who do not exploit in the first period but do so in the second iff

$$y - (f_t^* + p + q)\frac{\lambda_S}{1 - \lambda_S} > (f^\circ - f_{t+1}^*)\delta > (f^\circ - f_t^*)\frac{\lambda_S}{1 - \lambda_S}. \quad (20)$$

To meet this condition, we require  $y - (f_t^* + p + q)\frac{\lambda_S}{1 - \lambda_S} > (f^\circ - f_t^*)\frac{\lambda_S}{1 - \lambda_S}$  or equivalently  $y > \frac{\lambda_S(p+q)}{1 - \lambda_S(2 - \lambda_M)}$  which does not necessarily hold under assumption 1. If this is the case, the above condition may be satisfied, depending on  $\delta$ . Thus, it is possible to have a smuggler who does not exploit in the first period but does so in the second. This section thus derived a condition where some migrants might feel unfairly deceived by traffickers because social networks are so trusted.

**Proposition 6** *When potential migrants seek non-exploitative smuggling services and trust social networks, there is a fraction of migrants who pay a high price with a belief that they are hiring non-exploitative smugglers but are eventually exploited by them after border crossing iff the inequality (20) holds.*

To find out an equilibrium path over time, we need take into account the participation decision of each smuggling agent as well as its exploitation decision. This highly complicates the rational optimisation problem because, as the above table shows,  $f_{t+1}^*$  must be known in period  $t$  to decide on both exploitation and participation. But  $f_{t+1}^*$  need take into account the exploitation and participation decisions of all smuggling agents in that period which in turn

depend on  $f_{t+2}^*$  and so on. In addition, proposition 6 implies rational potential migrants need take into account the risk of hiring a trafficker at  $f^\circ$ .

In the next section, we solve for the equilibrium path of a special case: all smugglers are completely impatient, ie,  $\delta = 0$ . This significantly simplifies the analysis.

## 5.2 Impatient smugglers

When  $\delta = 0$ , the first-period decision making of smugglers does not depend on the future. Smugglers thus make their exploitation and participation decisions in the first period without taking into account the endogeneity of the second-period profit. This implies a static equilibrium in section 4 is reached initially. Let us assume a full participation equilibrium is reached in period 0, ie,  $\bar{f} < f_0^*$ . Accordingly, there are  $\Phi(\tilde{k}_0^*)$  non-exploitative smugglers and  $1 - \Phi(\tilde{k}_0^*)$  traffickers in period 0.

In period 1, there are 1 period-0 smuggling agents and 1 new smuggling agents in the economy. Because all period-0 non-exploitative smugglers are identified through social networks, they are able to charge the full information fee,  $f^\circ$ , in period 1 if there is no incentive for them to become exploitative in that period. For convenience, let  $E^* \equiv E[k|k \in K^*]$ .

**Lemma 4** *An impatient smuggler who does not exploit its client in its first period neither does so in the second.*

**Proof.** (i) A period- $t$  smuggler with  $k \leq \tilde{k}_t^*$  exploits its client in period  $t + 1$  if  $\tilde{\pi}(f^\circ, k) > 0$ . However,  $\tilde{\pi}(f^\circ, k) > 0 \Leftrightarrow k > \tilde{k}^\circ$ . Since  $f^\circ > f_t^* \Rightarrow \tilde{k}^\circ > \tilde{k}_t^*$  by lemma 1,  $\tilde{\pi}(f^\circ, k) < 0 \forall k \in [0, \tilde{k}_t^*]$ . (ii) A period- $t$  smuggler with  $k \leq \tilde{k}_t^*$  also exploits its client in period  $t + 1$  if  $\hat{\pi}(f^\circ, \tilde{\pi} = 0) \leq \hat{\pi}(f_{t+1}^*, \tilde{\pi}(f_{t+1}^*, k))$  by charging  $f_{t+1}^*$  instead of  $f^\circ$ . This condition can be rewritten as

$$k \geq \tilde{k}_{t+1}^\dagger \equiv \frac{[1 - (1 - \lambda_S)^2 (1 - E_{t+1}^*)]f^\circ + \lambda_S p}{(1 - \lambda_S)y - \lambda_S q}$$

which implies iff  $\tilde{k}_{t+1}^\dagger \leq \tilde{k}_t^*$  there is such a smuggler whose capacity is  $k \in [\tilde{k}_{t+1}^\dagger, \tilde{k}_t^*]$ . By (14),  $\tilde{k}_{t+1}^\dagger \leq \tilde{k}_t^* \Leftrightarrow 1 - (1 - \lambda_S)^2 (1 - E_{t+1}^*) \leq \lambda_S (1 - \lambda_S) (1 - E_t^*)$ , which is impossible as  $1 - \lambda_S E_t^* - (1 - \lambda_S) E_{t+1}^* < \frac{1}{1 - \lambda_S}$ . ■

Part (ii) of the proof suggests non-exploitative period- $t$  smugglers do not choose to remain unidentifiable in period  $t + 1$ . Lemma 1 implies, if there is any non-exploitative smuggler in the informationally asymmetric part of the market in

period  $t$ , it then operates in the informationally symmetric part of the market in period  $t + 1$ .

For period-0 traffickers and all period-1 potential suppliers, the exploitation capacity is private information. Hence they can charge  $f_1^*$ . They cannot pretend to be non-exploitative smugglers and charge  $f^\circ$  because rational workers who could not hire a period-0 non-exploitative smuggler who is identified via social networks should expect to hire in the informationally asymmetric part of the market.

**Lemma 5** *The average exploitation capacity in the asymmetric part of the market is non-decreasing over time. It converges to  $E_x^*$  in period  $x$  such that  $f_x^* \leq \bar{f}$  and  $f_{x-1}^* > \bar{f}$ .*

**Proof.** Lemma 1 implies there always are some period- $t-1$  traffickers operating in period  $t$ . The average capacity in period 0 is written out in (19). For period 1 onwards, with time-invariable  $\Phi(k)$ , it is

$$E_t^* = \begin{cases} \left( 2 \int_0^1 k\phi(k) dk - \int_0^{\tilde{k}_{t-1}^*} k\phi(k) dk - \int_0^{\tilde{k}_t^*} k\phi(k) dk \right) \left( 2 - \Phi(\tilde{k}_{t-1}^*) \right)^{-1} & \text{if } f_t^* > \bar{f} \\ \left( \int_0^1 k\phi(k) dk - \int_0^{\hat{k}_x^*} k\phi(k) dk \right) \left( 1 - \Phi(\hat{k}_x^*) \right)^{-1} & \text{otherwise.} \end{cases} \quad (21)$$

(17), (14) and (21) implies  $E_0^* < E_1^* \Rightarrow f_1^* < f_0^* \Rightarrow \tilde{k}_1^* < \tilde{k}_0^* \Rightarrow E_0^* < E_1^*$  if  $f_1^* > \bar{f}$ . When  $f_{x-1}^* > \bar{f}$  and  $f_x^* \leq \bar{f}$ , there is no active period- $x$  non-exploitative smuggler. In addition, period- $x-1$  traffickers with  $k \in (\tilde{k}_{x-1}^*, \hat{k}_x^*]$  do not operate. Only period- $x-1$  and period- $x$  traffickers with  $k \in (\hat{k}_x^*, 1]$  are active. With time-invariable  $\Phi(k)$ , the average capacity does not change from period- $x+1$  onwards. In period  $x$ , the fact that  $1 - \Phi(\hat{k}_x^*)$  period- $x-1$  traffickers with  $k \in (\hat{k}_x^*, 1]$  are active results in  $f_x^* \leq \bar{f}$ . In period  $x+1$ , there are  $1 - \Phi(\hat{k}_x^*)$  active period- $x$  traffickers with  $k \in (\hat{k}_x^*, 1]$ , so  $f_{x+1}^* = f_x^* \leq \bar{f}$ . ■

Lemma 5 suggests traffickers in their first period continue to be exploitative, if active, in the second.

**Corollary 2** *An impatient smuggler who exploits its client in the first period also does so, if active, in the second.*

Lemmas 4 and 5 suggest the behaviour of an impatient smuggling agent over time is rather simple. They lead to the following proposition about the equilibrium over time.

**Proposition 7** *Suppose  $f_0^* > \bar{f}$ . If smuggling agents are impatient and if it is not possible for workers to identify traffickers, there exists a unique dynamic equilibrium path where the number of active non-exploitative smugglers decreases over time while the average exploitative capacity rises. In the long run, the equilibrium converges to the one characterised by adverse selection: only traffickers are active even though each worker is willing to pay  $f^\circ > \bar{f}$  to a non-exploitative smuggler.*

**Proof.** If  $\delta = 0$ , definition 1 characterises the period-0 equilibrium.  $f_0^* > \bar{f}$  suggests all smuggling agents are active in period 0. (i) By lemma 4, as far as  $f_t^* > \bar{f}$ , there is at least one active non-exploitative smuggler in period  $t + 1$ , charging  $f^\circ$ . Lemma 5 suggests the number of non-exploitative smugglers who move from the informationally asymmetric part in  $t$  to the symmetric in  $t + 1$  is decreasing over time. In period  $x$ , there is no active non-exploitative smuggler in the informationally asymmetric part of the market because  $f_x^* \leq \bar{f}$ . Lemma 5 then implies there is no non-exploitative smugglers in either part of the market from period  $x + 1$  onwards. (ii) In the informationally asymmetric part of the market, there are 1 period- $t$  smuggling agents and period- $t - 1$  traffickers from period 1 onwards. All of them are active as far as  $f_t^* > \bar{f}$ . Lemma 5 implies the number of non-exploitative smugglers is decreasing over time. In period  $x$ , only traffickers with  $k \in (\hat{k}_x^*, 1]$  are active because  $f_x^* \leq \bar{f}$ . By lemma 5, we have  $f_t^* = f_x^*$  and  $\hat{k}_t^* = \hat{k}_x^*$  for all  $t = x + 1, x + 2, \dots, \infty$ . (i) and (ii) then suggest the long-run equilibrium requires the participation of only traffickers and is stable once non-exploitative smugglers stop operating in the market. ■

The migrant smuggling market thus becomes increasingly exploitative in the long run because of the cumulative effect of incumbent traffickers. Since the equilibrium becomes stable once all non-exploitative smugglers stop being active, the market does not vanish but continues to exist with only traffickers. Although the result is of a special case where all smuggling agents are impatient, its significance is that it is the very attempt of migrants to reduce the risk of hiring traffickers that subjects the migrant smuggling market to adverse selection over time.

The dynamics of our model is similar to Janssen and Karamychev (2002) and Janssen and Roy (2004). In their model, the average quality in the market rises over time because the stock of high-quality suppliers increases relative to low-quality suppliers. As a result, all goods are eventually traded over time when the market price rises sufficiently high. In our model, there is a source of information transmission via social networks, which is imperfect and divides the market into two parts. In the informationally asymmetric part

of the market, the average exploitation capacity rises over time because non-exploitative smugglers exit to the informationally symmetric part of the market through social networks. A new entry of non-exploitative smugglers ceases eventually, and adverse selection leads the market to a stable state where only exploitative agents are active in the long run.

## 6 Concluding remarks

Our analysis provides an economic rationale for smuggling and trafficking in migrants. Our framework indicates there is a trade-off between the number of active smuggling agents and the average exploitation in the market. Policies that reduce the number of active smuggling agents inevitably raise the average exploitation. Policymakers are thus likely to face a dilemma of whether to minimise the incidence of exploitation of trafficked migrants or to reduce the availability of smuggling services. (Proposition 2)

The migrant smuggling market can prosper because of the very situation where potential migrants are unable to distinguish between exploitative and non-exploitative smugglers. As far as the market is supplied by both exploitative and non-exploitative types, a potential migrant has a chance to hire a non-exploitative smuggler and gain a significantly higher surplus than under symmetric information. (Proposition 3)

The trust in social networks can be welfare worsening because it may generate an incentive for some traffickers to alternate their actions between not exploiting and exploiting over time. As a result, there may be potential migrants who pay high fees by thinking they are hiring non-exploitative smugglers but are eventually exploited in the destination. (Proposition 6)

In the short run, the market may be supplied by both smugglers and traffickers. However, with impatient smuggling agents and potential migrants' distrust in agents who are not referred by social networks, non-exploitative smugglers eventually cease to operate. In the long run, the market converges to a state where only traffickers of various exploitation capacities serve potential migrants. (Proposition 7)

These results indicate why potential migrants are willing to hire smugglers even though there is a risk of being exploited (Proposition 3) and why some smuggled migrants feel deceived even though they use social networks in planning their clandestine migration (Proposition 6). It might be that, if exploitation is becoming severer than before, it is a byproduct of a successful reduction in the number of smuggling activities overall (Proposition 2).

## References

- Akerlof, G.A., 1970, The market for “lemons”: quality uncertainty and the market mechanism, *Quarterly Journal of Economics* **84**(3): 488-500.
- Anderson, B., O’Connell Davidson, J., 2003, Is trafficking in human beings demand driven?: a multi-country pilot study, *IOM Migration Research Series* **15**, Geneva: International Organization for Migration.
- Aronowitz, A.A., 2001, Smuggling and trafficking in human beings: the phenomenon, the markets that drive it and the organisations that promote it, *European Journal on Criminal Policy and Research* **9**: 163-195.
- Bickley, C., ed., 2001, *Away from Azerbaijan, Destination—Europe: Study of Migration Motives, Routes and Methods*, Baku: International Organization for Migration.
- Bond, E.W., Chen, T.-J., 1987, The welfare effects of illegal immigration, *Journal of International Economics* **23**: 315-328.
- Budapest Group, 1999, The relationship between organised crime and trafficking in aliens, Vienna: International Centre for Migration Policy Development.
- Cornelius, W.A., 2001, Death at the border: efficacy and unintended consequences of US immigration control policy, *Population and Development Review* **27**(4): 661-685.
- CTRCP (Counter-Trafficking Regional Clearing Point), 2003, First annual report on victims of trafficking in South Eastern Europe, Vienna: Stability Pact Task Force on Trafficking in Human Beings.
- Dessy, S., Pallage, S., 2003, The economics of child trafficking, *CIRPÉE Working Paper* **03-23**, Montréal: Université du Québec à Montréal.
- \_\_\_\_\_, Mbiekop, F., Pallage, S., 2005, The economics of child trafficking (part II), *CIRPÉE Working Paper* **05-09**, Montréal: Université du Québec à Montréal.
- Djajić, S., 1987, Illegal aliens, unemployment and immigration policy, *Journal of Development Economics* **25**: 235-249.
- Donato, K.M., Durand, J., Massey, D.S., 1992, Stemming the tide?: assessing the deterrent effects of the immigration reform and control act, *Demography* **29**(2): 139-157.
- Erder, S., Kaska, S., 2003, *Irregular Migration and Trafficking in Women: the Case of Turkey*, Geneva: International Organization for Migration.
- Espinosa, K., Massey, D., 1997, Undocumented migration and the quantity and quality of social capital, *Soziale Welt* **12**: 141-162.
- Ethier, W.J., 1986, Illegal immigration: the host-country problem, *American Economic Review* **76**(1): 56-71.
- European Commission, 2004, Study on the links between legal and illegal migration, COM(2004) 412 final, Brussels: Commission of the European Communities.
- Frejka, T., Okólski, M., Sword, K., eds., 1998, In-depth studies on migration in Central and Eastern Europe: the case of Poland, *United Nations Economic Commission for Europe and United Nations Population Fund Economic Studies* **11**, Geneva: United Nations.
- \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_, eds., 1999, In-depth studies on migration in Central and Eastern Europe: the case of Ukraine, *United Nations Economic Commission for Europe and United Nations Population Fund Economic Studies* **12**, Geneva: United Nations.
- Friebel, G., Guriev, S., 2004, Smuggling humans: a theory of debt-financed migration, *IZA Discussion Paper* **1025**, Bonn: Institute for the Study of Labor.
- Futo, P., Jandl, M., eds., 2004, *2003 Year Book on Illegal Migration, Human Smuggling and Trafficking in Central and Eastern Europe: A Survey and Analysis of Border Management and Border Apprehension Data from 19 States*, Vienna: International Centre for Migration Policy Development.

- Gallagher, A., 2002, Trafficking, smuggling and human rights: tricks and treaties, *Forced Migration Review* **12**: 25-28.
- Gathmann, C., 2004, The effects of enforcement on illegal markets: evidence from migrant smuggling along the southwestern border, *IZA Discussion Paper* **1004**, Bonn: Institute for the Study of Labor.
- Genicot, G., Senesky, S., 2004, Determinants of migration and “coyote” use among undocumented Mexican migrants to the U.S., Paper presented at SOLE 2004, Graduate School of Business, University of Chicago.
- Ghosh, B., 1998, *Huddled Masses and Uncertain Shores: Insights into Irregular Migration*, Hague: Martinus Nijhoff.
- Guzman, M.G., Haslag, J.H., Orrenius, P.M., 2002, Coyote crossings: the role of smugglers in illegal immigration and border enforcement, *Federal Reserve Bank of Dallas Economic Research Working Paper* **0201**.
- Harris, J.R., Todaro, M.P., 1970, Migration, unemployment and development: a two-sector analysis, *American Economic Review* **60**(1): 126-142.
- Home Office, 2004, Paying the price: a consultation paper on prostitution, London: Home Office.
- Hughes, D.M., 2000, The “Natasha” trade: the transnational shadow market of trafficking in women, *Journal of International Affairs* **53**(2): 625-651.
- İçduygu, A., Toktas, S., 2002, How do smuggling and trafficking operate via irregular border crossings in the Middle East?—Evidence from fieldwork in Turkey, *International Migration* **40**(6): 25-54.
- \_\_\_\_\_, 2003, Irregular migration in Turkey, *IOM Migration Research Series* **12**, Geneva: International Organization for Migration.
- ILO, 2002, Forced labour, child labour and human trafficking in Europe: an ILO perspective, Technical paper prepared for the EU/IOM STOP conference, Preventing and Combating Trafficking in Human Beings, Brussels, Belgium.
- IND (Immigration and Nationality Directorate), 2001, Secure borders, safe haven: integration with diversity in modern Britain, Croydon: Home Office.
- IOM, 1996, Trafficking in women to Austria for sexual exploitation, Geneva: International Organization for Migration.
- \_\_\_\_\_, 2001, Hardship abroad or hunger at home: a study of irregular migration from Georgia, Tbilisi: International Organization for Migration.
- \_\_\_\_\_, 2002a, Irregular migration and smuggling of migrants from Armenia, Yerevan: International Organization for Migration.
- \_\_\_\_\_, 2002b, Shattered dreams: report on trafficking in persons in Azerbaijan, Geneva: International Organization for Migration.
- \_\_\_\_\_, ICMC (International Catholic Migration Commission), 2002, Second research report on third country national trafficking victims in Albania, Tirana: International Organization for Migration.
- \_\_\_\_\_, 2003, *World Migration 2003: Managing Migration—Challenges and Responses for People on the Move*, Geneva: International Organization for Migration.
- Janssen, M.C.W., Karamychev, V.A., 2002, Cycles and multiple equilibria in the market for durable lemons, *Economic Theory* **20**: 579-601.
- \_\_\_\_\_, Roy, S., 2004, On durable goods markets with entry and adverse selection, *Canadian Journal of Economics* **37**(3): 552-589.
- Kelly, L., Regan, L., 2000, Stopping traffic: exploring the extent of, and responses to, trafficking in women for sexual exploitation in the UK, *Police Research Series* **125**, London: Research, Development and Statistics Directorate, Home Office.
- Kim, J.-C., 1985, The market for “lemons” reconsidered: a model of the used car market with asymmetric information, *American Economic Review* **75**(4): 836-843.

- Koser, K., 2000, Asylum policies, trafficking and vulnerability, *International Migration*, Special issue 2000/1: 91-111.
- Kyle, D., Koslowski, R., eds., 2001, *Global Human Smuggling: Comparative Perspectives*, Baltimore, MD: Johns Hopkins University Press.
- Laczko, F., Thompson, D., eds., 2000, *Migrant Trafficking and Human Smuggling in Europe: A Review of the Evidence with Case Studies from Hungary, Poland and Ukraine*, Geneva: International Organization for Migration.
- Lăzăroiu, S., Alexandru, M., 2003, *Who is the Next Victim?: Vulnerability of Young Romanian Women to Trafficking in Human Beings*, Bucharest: International Organization for Migration.
- Leskinen, J., 2003, Organised pandering and prostitution in Finland, Trafficking in Women National Situation Report, Finland 2002, Lyon: Interpol.
- Marshall, P., 2001, Globalization, migration and trafficking: some thoughts from the South-east Asian region, *Occasional Paper 1*, Bangkok: United Nations Inter-agency Project on Trafficking in Women and Children in the Mekong Sub-region.
- Mas-Colell, A., Whinston, M.D., Green, J.R., 1995, *Microeconomic Theory*, Oxford: Oxford University Press.
- May, T., Harcopos, A., Hough, M., 2000, For love or money: pimps and the management of sex work, *Police Research Series Paper 134*, London: Home Office.
- Metropolitan Police, 2003, *Metropolitan Police Service and Metropolitan Police Authority Joint Annual Report 2002/03*, London: Metropolitan Police Service and Metropolitan Police Authority.
- Morrison, J., Crosland, B., 2001, The trafficking and smuggling of refugees: the end game in European asylum policy?, *New Issues in Refugee Research 39*, Geneva: United Nations High Commissioner for Refugees.
- NCIS, 2003, *United Kingdom Threat Assessment of Serious and Organised Crime 2003*, London: National Criminal Intelligence Service.
- OECD, 2000, *Combating the Illegal Employment of Foreign Workers*, Paris: Organisation for Economic Co-operation and Development.
- Orrenius, P.M., 1999, The role of family networks, coyote prices and the rural economy in migration from western Mexico: 1965-1994, *Federal Reserve Bank of Dallas Economic Research Working Paper 9910*.
- Pacurar, A., 2003, Smuggling, detention and expulsion of irregular migrants: a study on international legal norms, standards and practices, *European Journal of Migration and Law 5*(2): 259-283.
- Pieke, F.N., 2002, Recent trends in Chinese migration to Europe: Fujianese migration in perspective, *IOM Migration Research Series 6*, Geneva: International Organization for Migration.
- Pobortscha, A., 2002, Trafficking in women from the Republic of Moldova, *UNICRI Journal 2*, Turin: United Nations International Crime and Justice Research Institute.
- Raviv, T., Andreani, A., 2004, *Changing Patterns and Trends of Trafficking in Persons in the Balkan Region: Assessment carried out in Albania, Bosnia and Herzegovina, the Province of Kosovo (Serbia and Montenegro), the Former Yugoslav Republic of Macedonia and the Republic of Moldova*, Geneva: International Organization for Migration.
- Rose, C., 1993, Equilibrium and adverse selection, *RAND Journal of Economics 24*(4): 559-569.
- Salt, J., 2000, Trafficking and human smuggling: a European perspective, *International Migration*, Special issue 2000/1: 31-56.
- \_\_\_\_\_, 2003, Current trends in international migration in Europe, CDMG(2003) 39, Strasbourg: Council of Europe.
- Schloenhardt, A., 1999, Organised crime and the business of migrant trafficking: an economic analysis, *Crime, Law & Social Change 32*: 203-233.

- Singer, A., Massey, D., 1997, The social process of undocumented border crossing, *Lewis Center for Regional Policy Studies Working Paper 27*, Los Angeles, CA: University of California, Los Angeles.
- Skeldon, R., 2000a, Trafficking: a perspective from Asia, *International Migration*, Special issue 2000/1: 7-30.
- \_\_\_\_\_, 2000b, Myths and realities of Chinese irregular migration, *IOM Migration Research Series 1*, Geneva: International Organization for Migration.
- Taran, P.A., Chammartin, M.-F.G., 2003, Getting at the roots: stopping exploitation of migrant workers by organized crime, *Perspectives on Labour Migration 1*, Geneva: International Labour Office.
- Todaro, M.P., 1969, A model of labor migration and urban unemployment in less developed countries, *American Economic Review* **59**(1): 138-148.
- \_\_\_\_\_, 1970, Labor migration and urban unemployment: reply, *American Economic Review* **60**(1): 187-188.
- \_\_\_\_\_, Maruszko, L., 1987, Illegal migration and US immigration reform: a conceptual framework, *Population and Development Review* **13**(1): 101-114.
- Uehling, G., 2004, Irregular and illegal migration through Ukraine, *International Migration* **42**(3): 77-109.
- UN, 2000a, Protocol to prevent, suppress and punish trafficking in persons, especially women and children, supplementing the United Nations Convention against Transnational Organized Crime, New York: United Nations.
- \_\_\_\_\_, 2000b, Protocol against the smuggling of migrants by land, sea and air, supplementing the United Nations Convention against Transnational Organized Crime, New York, NY: United Nations.
- UNICRI, 2003, Coalitions against trafficking in human beings in the Philippines: research and action final report, Vienna: United Nations Office on Drugs and Crime.
- USDS, 2004, *Trafficking in Persons Report 2004*, Washington, DC: US Department of State.
- Väyrynen, R., 2003, Illegal immigration, human trafficking, and organized crime, *WIDER Discussion Paper 2003/72*, Helsinki: World Institute for Development Economics Research, United Nations University.
- Wilson, C.A., 1980, The nature of equilibrium in markets with adverse selection, *Bell Journal of Economics* **11**(1): 108-130.

# Appendix

## 1. Excerpts from UN (2000a) and UN (2000b)

*UN 2000b, Article 3(a)* “Smuggling of migrants” shall mean the procurement, in order to obtain, directly or indirectly, a financial or other material benefit, of the illegal entry of a person into a State Party of which the person is not a national or a permanent resident;

*UN 2000b, Article 3(b)* “Illegal entry” shall mean crossing borders without complying with the necessary requirements for legal entry into the receiving State;

*UN 2000a, Article 3(a)* “Trafficking in persons” shall mean the recruitment, transportation, transfer, harbouring or receipt of persons, by means of the threat or use of force or other forms of coercion, of abduction, of fraud, of deception, of the abuse of power or of a position of vulnerability or of the giving or receiving of payments or benefits to achieve the consent of a person having control over another person, for the purpose of exploitation. Exploitation shall include, at a minimum, the exploitation of the prostitution of others or other forms of sexual exploitation, forced labour or services, slavery or practices similar to slavery, servitude or the removal of organs;

*UN 2000a, Article 3(b)* The consent of a victim of trafficking in persons to the intended exploitation set forth in subparagraph (a) of this article shall be irrelevant where any of the means set forth in subparagraph (a) have been used;

## 2. Comparative statics: proof of proposition 2

From (19), by using the second fundamental theorem of calculus,

$$\begin{aligned} dE[k|k \in K]/d\bar{k}' &= -\bar{k}'\phi(\bar{k}') < 0 & \text{for } f > \bar{f}; \text{ and} \\ dE[k|k \in K]/d\hat{k}' &= (E[k|k \in K] - \hat{k}')\phi(\hat{k}')/(1 - \Phi(\hat{k}')) > 0 & \text{otherwise.} \end{aligned}$$

Note  $dE[k|k \in K]/d\hat{k}' > 0$  because  $K = (\hat{k}', 1]$  when  $f \leq \bar{f}$ .

Let us rearrange  $\bar{k}'(p, q, \lambda_M, \lambda_S)$  in (14) as follows:

$$F_1 \equiv \lambda_S(1 - \lambda_S)f^\circ(1 - E[k|k \in K]) + \lambda_S p - [(1 - \lambda_S)y - \lambda_S q]\bar{k}' = 0$$

By applying the implicit function theorem to  $F_1$ , we obtain the following derivatives:

$$\begin{aligned} d\bar{k}'/dp &= \lambda_S/A \\ d\bar{k}'/dq &= \lambda_S\bar{k}'/A \\ d\bar{k}'/d\lambda_M &= -\lambda_S(1 - \lambda_S)y(1 - E[k|k \in K])/A \\ d\bar{k}'/d\lambda_S &= [(y + q)\bar{k}' + p + (1 - 2\lambda_S)f^\circ(1 - E[k|k \in K])]/A \end{aligned}$$

where  $A \equiv (1 - \lambda_S)y[1 - \lambda_S(1 - \lambda_M)\bar{k}'\phi(\bar{k}')] - \lambda_S q$ .

Let us rearrange  $\hat{k}'(p, q, \lambda_M, \lambda_S, \beta_M, \beta_S)$  in (15) as follows:

$$F_2 \equiv \bar{f}(p, \beta_M, \beta_S) + \lambda_S p - (1 - \lambda_S)^2 f^\circ(1 - E[k|k \in K]) - [(1 - \lambda_S)y - \lambda_S q]\hat{k}' = 0$$

where  $\bar{f}$  is defined in (9). By applying the implicit function theorem to  $F_2$ , we obtain the following derivatives:

$$\begin{aligned} d\hat{k}'/dp &= \lambda_S/B + \frac{\beta_S}{(1 - \beta_S)(1 - \beta_M)^B} \\ d\hat{k}'/dq &= \lambda_S\hat{k}'/B \\ d\hat{k}'/d\lambda_M &= (1 - \lambda_S)^2 y(1 - E[k|k \in K])/B \\ d\hat{k}'/d\lambda_S &= [(y + q)\hat{k}' + p + 2(1 - \lambda_S)f^\circ(1 - E[k|k \in K])]/B \\ d\hat{k}'/d\beta_M &= \frac{\beta_S p + c + \bar{\pi}}{(1 - \beta_S)(1 - \beta_M)^2 B} \\ d\hat{k}'/d\beta_S &= \frac{p + c + \bar{\pi}}{(1 - \beta_S)^2(1 - \beta_M)^B} \end{aligned}$$

where  $B \equiv (1 - \lambda_S)y[1 - (1 - \lambda_S)(1 - \lambda_M)\frac{(E[k|k \in K] - \hat{k}')\phi(\hat{k}')}{1 - \Phi(\hat{k}')}] - \lambda_S q$ .

By referring to (16), let us now define

$$G(\beta_M, \beta_S, p, q, \lambda_M, \lambda_S) \equiv f - \bar{f} = (1 - \lambda_S) f^\circ (1 - E[k|k \in K]) - \frac{\beta_S p + c + \bar{\pi}}{(1 - \beta_S)(1 - \beta_M)}.$$

All smuggling agents are active when  $G > 0$ , while only  $1 - \Phi(\hat{k}')$  traffickers are active when  $G \leq 0$ . This implies the total number of active smuggling agents is decreasing in the average exploitation capacity. That is, an increase in  $G$  is associated with a reduction in the average exploitation capacity but at the expense of increasing the number of active smuggling agents in the market.

If  $G > 0$ , (19) indicates  $E[k|k \in K]$  is a function of  $\hat{k}'$ . Accordingly, we have the following derivatives:

$$\begin{aligned} dG/d\beta_M &= -d\bar{f}/d\beta_M = -\frac{\beta_S p + c + \bar{\pi}}{(1 - \beta_S)(1 - \beta_M)^2} < 0 \\ dG/d\beta_S &= -d\bar{f}/d\beta_S = -\frac{p + c + \bar{\pi}}{(1 - \beta_S)^2(1 - \beta_M)} < 0 \\ dG/dp &= \lambda_S(1 - \lambda_S) f^\circ \hat{k}' \phi(\hat{k}')/A - \frac{\beta_S}{(1 - \beta_S)(1 - \beta_M)} \\ dG/dq &= \lambda_S(1 - \lambda_S) f^\circ \hat{k}'^2 \phi(\hat{k}')/A \\ dG/d\lambda_M &= -\left[1 + \lambda_S(1 - \lambda_S) f^\circ \hat{k}' \phi(\hat{k}')/A\right] (1 - \lambda_S) y (1 - E[k|k \in K]) \\ dG/d\lambda_S &= \{(1 - \lambda_S) \hat{k}' \phi(\hat{k}') [(1 - \lambda_S) f^\circ (1 - E[k|k \in K]) + (y + q) \hat{k}' + p] \\ &\quad - [(1 - \lambda_S) y - \lambda_S q] (1 - E[k|k \in K])\} f^\circ / A \end{aligned}$$

Note  $\beta_M$  and  $\beta_S$  do not change  $G$  via  $f$ . This suggests, as far as  $G > 0$ , these parameters affect neither the ratio between smugglers and traffickers nor the average exploitation capacity.

If  $G \leq 0$ ,  $E[k|k \in K]$  is a function of  $\hat{k}'$ . Accordingly, we have the following derivatives:

$$\begin{aligned} dG/d\beta_M &= -\left[1 + (1 - \lambda_S) f^\circ (E[k|k \in K] - \hat{k}') \phi(\hat{k}') / (1 - \Phi(\hat{k}')) B\right] \frac{\beta_S p + c + \bar{\pi}}{(1 - \beta_S)(1 - \beta_M)^2} \\ dG/d\beta_S &= -\left[1 + (1 - \lambda_S) f^\circ (E[k|k \in K] - \hat{k}') \phi(\hat{k}') / (1 - \Phi(\hat{k}')) B\right] \frac{p + c + \bar{\pi}}{(1 - \beta_S)^2(1 - \beta_M)} \\ dG/dp &= -\left[\lambda_S + \frac{\beta_S}{(1 - \beta_S)(1 - \beta_M)}\right] (1 - \lambda_S) f^\circ (E[k|k \in K] - \hat{k}') \phi(\hat{k}') / (1 - \Phi(\hat{k}')) B - \frac{\beta_S}{(1 - \beta_S)(1 - \beta_M)} \\ dG/dq &= -\lambda_S(1 - \lambda_S) f^\circ (E[k|k \in K] - \hat{k}') \phi(\hat{k}') / (1 - \Phi(\hat{k}')) B \\ dG/d\lambda_M &= -\left[1 + (1 - \lambda_S)^2 f^\circ (E[k|k \in K] - \hat{k}') \phi(\hat{k}') / (1 - \Phi(\hat{k}')) B\right] (1 - \lambda_S) y (1 - E[k|k \in K]) \\ dG/d\lambda_S &= -\left\{[(1 - \lambda_S) f^\circ (1 - E[k|k \in K]) + (y + q) \hat{k}' + p] (1 - \lambda_S) (E[k|k \in K] - \hat{k}') \phi(\hat{k}') / (1 - \Phi(\hat{k}'))\right. \\ &\quad \left.+ [(1 - \lambda_S) y - \lambda_S q] (1 - E[k|k \in K])\right\} f^\circ / B \end{aligned}$$

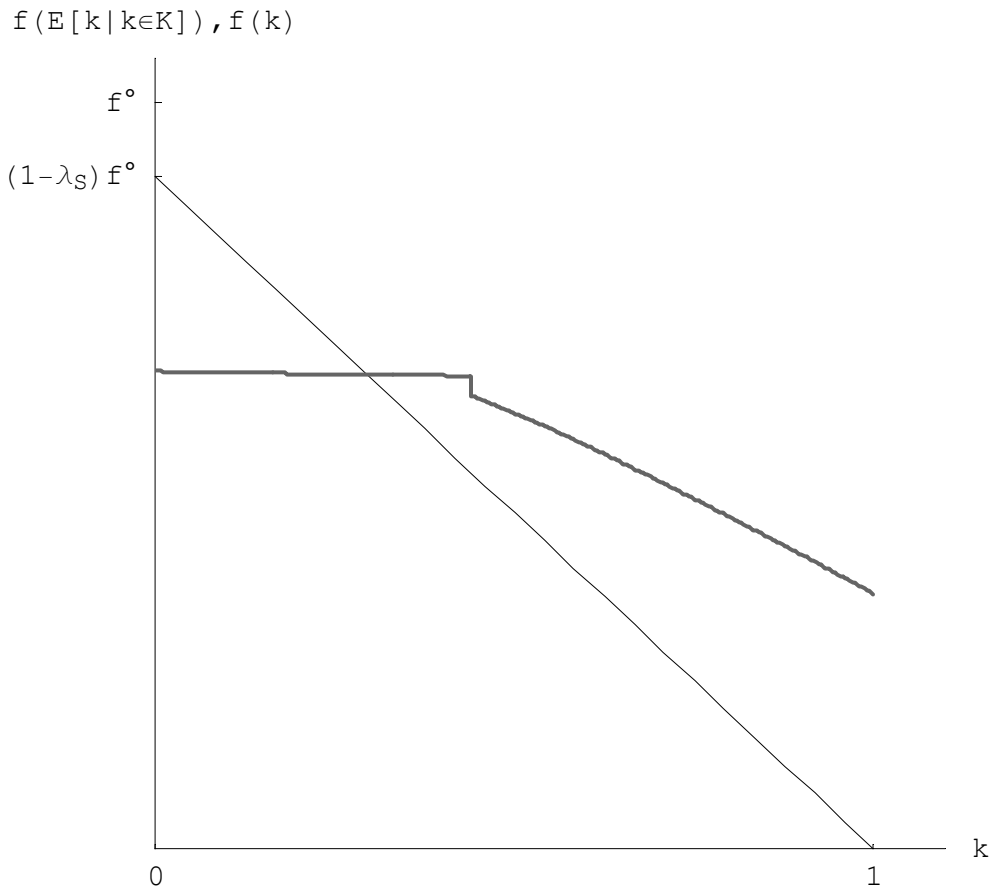
The following table summarises, by using the derivatives we obtained, how the average exploitation capacity in the market changes with respect to a change in a policy instrument. It shows the effects of government efforts to fight against human trafficking is ambiguous.

		AVERAGE EXPLOITATION			
	Sign	Condition under $f > \bar{f}$		Condition under $f \leq \bar{f}$	
$\beta_M, \beta_S$	+	$Q < 1 + \lambda_S \lambda_M^- \Omega$		$y$	
	-	$Q > 1 + \lambda_S \lambda_M^- \Omega$		$y$	
$p$	+	$Q < 1 - \theta \lambda_S \lambda_M^- \Psi$	$y$	$Q < 1 + \theta \lambda_S \lambda_M^- \Omega$	$y$
	-	$Q > 1 - \theta \lambda_S \lambda_M^- \Psi$	$y$	$Q > 1 + \theta \lambda_S \lambda_M^- \Omega$	$y$
$q$	+	$Q > 1 - \lambda_S \lambda_M^- \Psi$	$y$	$Q < 1 - \lambda_S^- \lambda_M^- \Omega$	$y$
	-	$Q < 1 - \lambda_S \lambda_M^- \Psi$	$y$	$Q > 1 - \lambda_S^- \lambda_M^- \Omega$	$y$
$\lambda_M$	+	$Q < y$		$Q < y$	
	-	$Q > y$		$Q > y$	
$\lambda_S$	+	$Q < [1 - \lambda_S^- \lambda_M^- \Psi - k' \Psi / \varepsilon] y - (p + q k') \Psi / \varepsilon$	$Q < [1 + \lambda_S^- \lambda_M^- \Omega + k' \Omega / \varepsilon] y + q k' \Omega / \varepsilon + p \Omega / \varepsilon$		
	-	$Q > [1 - \lambda_S^- \lambda_M^- \Psi - k' \Psi / \varepsilon] y - (p + q k') \Psi / \varepsilon$	$Q > [1 + \lambda_S^- \lambda_M^- \Omega + k' \Omega / \varepsilon] y + q k' \Omega / \varepsilon + p \Omega / \varepsilon$		

where  $\lambda_M^- \equiv 1 - \lambda_M > 0$ ;  $\lambda_S^- \equiv 1 - \lambda_S > 0$ ;  $Q \equiv \frac{\lambda_S}{1 - \lambda_S} q > 0$ ;  $\theta \equiv \frac{\beta_S + (1 - \beta_S)(1 - \beta_M)}{\beta_S} > 1$ ;  $\Psi \equiv \hat{k}' \phi(\hat{k}') > 0$ ;  $\Omega \equiv \frac{(E[k|k \in K] - \hat{k}') \phi(\hat{k}')}{1 - \Phi(\hat{k}')} > 0$ ; and  $\varepsilon \equiv 1 - E[k|k \in K] > 0$ .

However, under assumption 1,  $Q \not\geq y$ . Hence, if parameters can feasibly change only without violating assumption 1, we can reduce the table as follows. Proposition 2 is based on this.

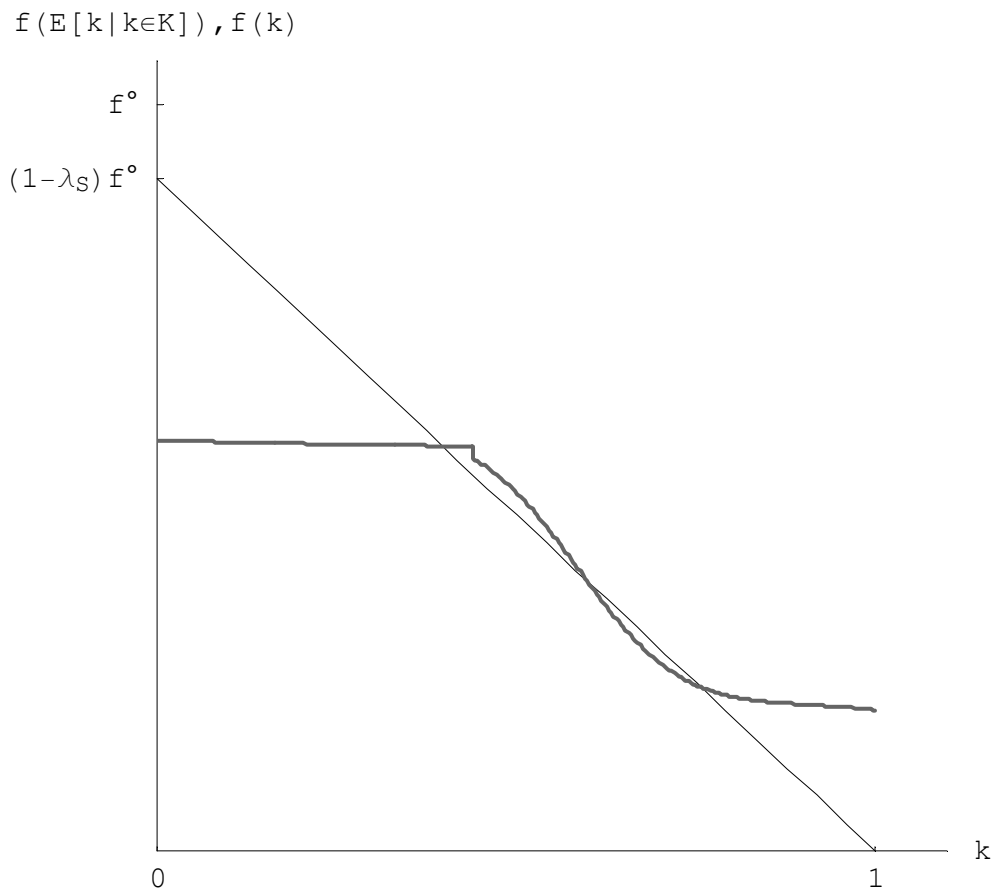
AVERAGE EXPLOITATION					
		Condition under $f > \bar{f}$	Condition under $f \leq \bar{f}$		
$\beta_M, \beta_S$		N.A.	+		
$p$	+ if $Q <$	$1 - \theta \lambda_S \lambda_M^- \Psi$	$y$	+	
	- if $Q >$	$1 - \theta \lambda_S \lambda_M^- \Psi$	$y$		
$q$	+ if $Q >$	$1 - \lambda_S \lambda_M^- \Psi$	$y$	+ if $Q <$	
	- if $Q <$	$1 - \lambda_S \lambda_M^- \Psi$	$y$	- if $Q >$	
				$1 - \lambda_S^- \lambda_M^- \Omega$	$y$
$\lambda_M$		+		+	
$\lambda_S$	+ if $Q <$	$[1 - \lambda_S^- \lambda_M^- \Psi - k' \Psi / \varepsilon] y - (p + qk') \Psi / \varepsilon$		+	
	- if $Q >$	$[1 - \lambda_S^- \lambda_M^- \Psi - k' \Psi / \varepsilon] y - (p + qk') \Psi / \varepsilon$			



**FIGURE 1**  
**UNIQUE COMPETITIVE EQUILIBRIUM FEE UNDER ASYMMETRIC INFORMATION**

The thinner linear line represents  $f(k) = (1 - \lambda_s) f^\circ (1 - k)$ . For the thicker line, we replace  $k$  with  $E[k | k \in K]$ . That is, it represents the expected fee schedule given the smuggling fee that is in turn based on the given average exploitation capacity in the market. It is downward sloping with a sudden drop in the middle where  $\bar{f} = f(k)$ , ie, all non-exploitative smugglers exit the market. The equilibrium is where the two lines cross, ie, the workers' expectation of the average exploitation capacity equals the actual average. The crossing point thus gives the equilibrium fee and the equilibrium average exploitation capacity.

NB: The parameters for the simulation are as follows:  $\beta_M = .3$ ,  $\lambda_M = .15$ ,  $\beta_S = .2$ ,  $\lambda_S = .1$ ,  $p = 2$ ,  $q = 1$ ,  $y = 10$ ,  $\bar{\pi} = 1$  and  $c = 1$ . Since the support of  $\Phi(k)$  is  $[0, 1]$ , we use a beta distribution for convenience. In particular, we assume 1.5 and 3.5 for the two parameters of the distribution of  $k$ . Accordingly, the majority of smugglers are modestly exploitative, ie, the value of  $k$  is not very high.



**FIGURE 2**  
**MULTIPLE COMPETITIVE EQUILIBRIUM FEES UNDER ASYMMETRIC INFORMATION**

There are three equilibrium points in the figure. Under the equilibrium that gives the highest fee and the lowest average exploitation capacity among these three, all smugglers are active regardless of their exploitation capacities. Under the other two equilibria, non-exploitative smugglers are absent.

NB: In this simulation, the environment is the same as for Figure 1 except the distribution function,  $\Phi(k)$ , which is now a combination of three different beta distributions. In particular, we used

$$\Phi(k) = .62I(k; 4, 20) + .2I(k; 16, 8) + .18I(k; 10, 1)$$

where  $I(k; \alpha, \beta)$  is the regularised beta function. Further details on the beta distribution can be found at <http://mathworld.wolfram.com/BetaDistribution.html>.

