Smuggling Humans:
A Theory of Debt-Financed Migration[1]

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Abstract

We introduce financial constraints in a theoretical analysis of illegal immigration. Intermediaries finance the migration costs of wealth-constrained migrants, who enter temporary servitude contracts to repay the debt. These debt/labor contracts are easier to enforce in the illegal than in the legal sector of the host country. Hence, when moving from the illegal to the legal sector becomes more costly, for instance, because of stricter deportation policies, fewer immigrants default on debt. This reduces the risks for intermediaries, who are then more willing to finance illegal migration. Stricter deportation policies may thus, *ex ante*, increase rather than decrease the flow of illegal migrants. Furthermore, stricter deportation policies worsen the skill composition of immigrants. While stricter border controls decrease overall immigration, they may result in an increase of debt-financed migration. We also show that there are complementarities between employer sanctions and deportation policies. We use available evidence to check the empirical consistency of the theory.

Keywords: Illegal migration, wealth constraints, indentured servitude, financial contracting

JEL Classification Codes: J61, K42, O17

1 Introduction

Illegal migration is a problem of growing scale and importance. The most conservative estimates (Skeldon, 2000) amount to a worldwide stock of irregular migrants exceeding 10 million. The International Organization for Migration believes that half of all new entrants into developed economies are illegal (IOM, 2003). According to the United Kingdom Home Department, 75% of illegal migrants use the expensive services of smugglers (see IOM, 2003, page 63). Migrants and their families often cannot self-finance costs that commonly reach several tens of thousands of US dollars. Hence, migrants endebt themselves. Smugglers and other intermediaries finance the costs of undocumented entry, and the debt repayment is taken out of migrants' wages in sweatshops and restaurants that are related to these intermediaries (Chin, 1999, IOM, 2000).

Owing to its multi-billion USD size (Kyle and Koslowski, 2001) and its inhumane nature, human smuggling causes much concern in public opinion. Given increasing international wage differentials, unstable political circumstances and the importance of financial constraints in most source countries of migration, the demand for human smuggling services may rise further. It is therefore important to consider the interactions between wealth-constrained migrants and intermediaries in an economic theory of illegal migration. To the best of our knowledge, our paper is the first attempt to carry out such analysis.

There are three types of policies against illegal immigration: (i) border controls, (ii) deportation and legalization policies, and (iii) work-site inspections, raids and sanctions against employers of illegal immigrants. In our basic theory, we focus on the first two policies, and study the third type of policies in an extended model (Section 7). In Ethier's (1986) model on illegal migration and other papers building on his work, all these policies have similar, negative effects on illegal immigration. The effect of border controls in our framework is similar to the literature, but the effect of stricter deportation policies differs substantially. In our model, stricter deportation policies increase rather than decrease the flow of illegal migrants. We also show that they worsen the skill composition of immigrants.

We derive these results in a simple model of financial contracting between wealth-constrained migrants and intermediaries. The model is motivated and based on the sociological evidence about the relationship between intermediaries and immigrants, which we summarize in Section 2. We lay out the model in Section 3 and analyze it in Section 4. In the model, there is a source country from which workers may wish to migrate to earn higher wages in the host country. In the host country there are an illegal and a legal sector. Migration costs must be paid upfront, but many potential migrants do not have enough cash. Wealthy intermediaries/smugglers can provide migrants with funds. If

the migrant has no collateral, there is only one way to make the debt contract between intermediary and migrant enforceable. The migrant commits himself to work exclusively for the intermediary in the source country until the debt is paid back. We will refer to these contracts as "debt/labor contracts".

Debt/labor contracts collide with labor law. As long as a migrant is employed in the illegal sector, the debtholders can enforce the contract through coercion. This is more difficult when a migrant is legalized, because in the legal sector of the economy, the migrant receives some protection from the host country's legal system. Thus, migrants who move successfully to the legal sector can default on their debt payment. But, there are costs associated with moving: in the legal sector, migrants become visible to law enforcement agencies. This exposes them to higher risks of being deported to the source country. When deportation policies become stricter, migrants are hence less likely to try moving to the legal sector and there are, then, less defaults on debt repayments. This implies that financing migrants becomes more rewarding for intermediaries and, hence, that the flow of migrants financed by debt/labor contracts increases. At the same time, the net present value of migration for wealthier self-financed migrants decreases, which reduces their inflow. The net effect on total migration flows is ambiguous, but migrant skill composition deteriorates unambiguously, given the strong positive correlations between wealth and skills in developing countries (Piketty, 2000).

Our results hold under the following crucial assumptions. First, we presume that migrants' wealth constraints are binding. Our theory therefore applies mainly to long-haul migration, for instance from China or South Asia to the US or EU, where migration costs are too high to be paid upfront. It may be less appropriate for short-haul migration, for instance, between Mexico and the US, or Albania and Italy, although even here, prices for illegal immigration appear substantial, making it more likely that migrants need external sources of finance. Second, it is harder to enforce the debt/labor contract when migrants have successfully moved to the legal sector of the host country. Intermediaries cannot inflict infinitely costly penalties on defaulting migrants in the legal sector. Third, we assume that the attempt to obtain legal status in the host country increases an illegal immigrant's risks of being deported. It is exactly the fear of deportation that prevents immigrants from seeking police protection against illegal debt collectors.

Finally, our model assumes rational behavior of migrants and intermediaries, and that nobody is forced or tricked to enter a debt/labor contract. We do not look at involuntary slavery, which is an important problem, but is mostly unrelated to international migration (Bales, 2000). We also distinguish voluntary debt/labor contracts under more or less perfect information from human trafficking, which involves manipulation of information

and kidnapping or coercion.

There is a growing theoretical literature that investigates the effects of host country policies on illegal immigration. Ethier (1986) introduced a theoretical framework in which governments optimally use a mix of external and internal enforcement mechanisms, in particular, employer sanctions to combat illegal immigration. Recent papers have extended this framework to study the dynamic issues of illegal immigration control. Epstein et al. (1999) look at the problem of migrants who enter legally and subsequently move into the illegal sector in order to avoid deportation. Chau (2001) argues that amnesties for illegal immigrants can help deal with issues of time inconsistency of employer sanctions. Epstein and Weiss (2001) investigate the strategic interaction of immigrants and host countries and the optimal design of amnesties. Djajic (1999) argues that stricter immigration control may be counterproductive as migrants may move into new sectors and new areas, where new migration networks may form.

Our paper is also building on the model of Ethier (1986), but we do not look at the dynamic aspects of immigration control. Rather, our contribution is to elaborate the consequences of wealth-constraints and the interaction between migrants and intermediaries in a theory of illegal migration. The model shows that under these circumstances, stricter border controls and stricter deportation policies have quite different effects on the flow and composition of illegal migrants.

In Section 5, we check the empirical consistency of the model with the scarce data available. Section 6 relaxes some of the simplifying assumptions of the model. We allow for debt collection in the legal sector of the host country and for general distribution functions of wealth and skills. This establishes the additional result that stricter border controls may result in an increase of debt-financed migration. We also sketch models of the effects of smuggler market power, of vertical separation between smugglers and employers, and of legal entry of migrants. The main results obtain under these different scenarios. In Section 7, we look at employer sanctions. We show that there can be complementarities between employer sanctions and deportation policies. Without employer sanctions, stricter deportation promotes debt-financed migration and decreases self-financed migration. The total effect is hence ambigious. With intensified employer inspections and sanctions, deportation policy becomes a more effective tool for decreasing migration. In Section 8, we discuss normative considerations and how the theory applies to human trafficking. We also look at parallels from the history of migration through indentured servitude to the British colonies in the 17th and 18th century. Section 9 concludes.

2   Intermediaries and migrants: evidence

Most of the available sociological and criminological research on debt-financed migration concerns illegal migration from China, which appears to be the most important source country for long-haul illegal migration under wealth constraints. Similar but less well researched arrangements are also reported for other source countries, for instance, the Balkans (Business Week, 2000) and India (INS, 1998a), and for illegal migration from Africa to Europe (Petros, 2005). We here present evidence about (a) information available to potential migrants, (b) debt/labor contracts between intermediaries and migrants, (c) the organization of intermediaries, and (d) repayment of debt. The facts presented below motivate the setting of the model.

Information: There are important and often blurred distinctions between human trafficking and smuggling (see Laczko, 2002, Salt, 2001). The availability of information is crucial. Young women and children are sometimes tricked or forced into prostitution, but it appears that most migrants know quite well what to expect (Skeldon, 2000). This concerns not only the costs and non-monetary risks involved with illegal migration, but also the initially poor living conditions in host countries. Chin and Zhang (2002) show that most Chinese migrants come from the same few provinces. They benefit from the information of relatives and friends who have migrated before. Some pieces of information may be lacking, but this can only be a transitory phenomenon. O'Rourke and Williamson (1999) document that even 19th century migrants were well informed about their prospects, at a time when information travelled by boat. There is little reason to believe that in the presence of information and telecommunication technologies, informational frictions would persist for long.

Debt/labor contract: Costs of migration are high, and only few wealthy individuals or families can afford to self-finance migration. For instance, China-US smuggling fees reached USD 35,000 in mid 1990s and continued to rise to USD 40-50 thousand since then (Chin, 1999, Kwong, 1997, 2001, INS, 1998b, New York Times, 2000b). The fees for passage from China to Europe, or from India to the US are lower but still above USD 20,000 (Business Week, 2000, New York Times, 2000a, INS, 1998a). It is interesting that within the same route (e.g. Fujian – New York) fees do not seem to vary substantially across individuals.

A survey of three hundred illegal Chinese immigrants from Fujian province shows that 90% had to borrow to pay the fee (Chin, 1999). However, many potential migrants have access to intermediaries who arrange air, sea or ground transport, provide forged documents and assist in entering the country of destination. Long-haul migration is organized (Schloenhardt, 1999) in rather similar ways whether migrants come from China,

Russia (Finckenauer, 2001), or Asia (Business Week, 2000). The migrant may or may not pay a downpayment of up to 20 percent of the total fee. Smuggler networks arrange the transfer to the host country, by sea, land or air transport. They also help to enter the host country. Upon arrival, the migrant is usually kept in a "safe house" or sweatshop until the debt has been paid back to the smuggler or related businesses. The migrant thus provides his labor as collateral to the smuggler or its business partners until the debt is paid back.

Organization of intermediaries: There is agreement that the supply side of the market for illegal migration consists of an oligopoly of well-organized and profitable networks of intermediaries (Schloenhardt, 1999, INS, 1998b). Smugglers oftentimes re-invest the returns into the smuggling business (Chin and Zhang, 2002), which indicates that they have long-term horizons. Reputational concerns appear to keep smugglers and their partners from treating migrants too badly or from extending their temporary servitude unduly. In particular, workers are usually set free after the debt has been paid back (Chin, 1999). Otherwise, new migrants would barely enter contractual relationships with smugglers.

Intermediaries are not always integrated; smugglers may provide finance, but sweatshops are often independent customers of the networks' services. We know rather little about contractual imperfections between smugglers and employers. Furthermore, the degree of vertical integration is not important for our main argument. Hence, the model builds on the assumption that intermediaries are integrated. In 6.4 we briefly look at the vertical structure of intermediaries.

Repayment of debt: Sometimes, relatives of the migrant pay the debt, but usually the migrant works in businesses associated with the intermediary he used, and the debt is paid back from his wage. In the case of Fujian Chinese, repayment takes between half a year and four years with an average of 26 months (Chin, 1999, p. 119). Much of the illegal migration business appears to follow the spirit of the debt/labor contract quite closely.

3   The model

There are two risk-neutral players, M and I. A potential migrant M ('he', occasionally also called "the worker") lives in the source country and wishes to migrate to the host country, which does not permit legal entry. Thus, M needs the services of a smuggler or intermediary I ('it'). The migrant is wealth-constrained, while the intermediary has unlimited access to credit at zero cost. Government policies are modelled in terms of comparative statics.

Below we posit two assumptions that are crucial for our theory. Their role is further

discussed and they are relaxed in Sections 6 and Section 7.

Assumption 1 *Moving from the illegal to the legal sector of the host country exposes illegal migrants to higher risks of being deported.*

In the basic model, we will assume that the risk of being detected is zero as long as the migrant stays in the illegal sector. (This makes sense in the absence of systematic employer checks. In Section 7, we do consider the effect of employer inspections). But, when moving out of the illegal sector, a migrant becomes more visible for public enforcement agencies, especially if he wants to obtain a legal job, and protection from smugglers. This exposes him to a higher risk of being arrested and deported.

Assumption 2 *It is harder to enforce the debt/labor contract when migrants have obtained legal status.*

This assumption states that being legalized, migrants receive some protection against coercion and that intermediaries cannot inflict infinitely harsh punishments on defaulting migrants. In the basic model, we assume for simplicity that there is perfect enforcement of the debt/labor contract in the illegal sector, while in the legal sector, M is perfectly protected from coercion by I. In Section 6, we show that the results continue to hold when allowing for (imperfect) debt collection in the legal sector.

3.1 Timing and migration contract

The parties maximize their respective payoffs U^M (migrant) and U^I (intermediary), over two periods. Without loss of generality, the time discount is zero. Figure 1 shows the timing.

At the beginning of the *first* period, M makes I a take-it-or-leave-it offer.[1] The contract specifies that I pays the costs of taking M to the illegal sector of the host country and that M is supposed to make a downpayment p_1 that is not exceeding the migrant's initial wealth a, and a payment p_2 in the second period. The migrant owns no collateral other than his labor. Hence, the contract stipulates that until p_2 is paid, I or

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[1]This implies that the market for smugglers is competitive, a simplifying assumption that is not important for the results. Section 6 allows for smugglers to have market power, which does not change the main results. Notice also that the anecdotal evidence presented in Section 2 suggests that there is competition between smugglers: fees depend on routes (the longer/difficult routes are more expensive). Also, for any given route, there seems to be no price discrimination across migrants (although this may be due to asymmetric information between smugglers and migrants, an effect that we do not model).

its business partners[2] own the revenue of M's work. This contract puts M in a situation of temporary, voluntary servitude. The intermediary either accepts or rejects the offer. If I rejects and M stays (index "s") in the source country, the payoffs are:

$$U_s^M = a + \omega,$$
$$U_s^I = 0.$$

Here, ω is M's wage in the source country. If I accepts the offer, M migrates. Migration involves costs of entry into the host country C that are borne by I. These costs C are the first policy variable of the model: stricter border controls increase C. During the *second* period, M either stays in the illegal sector working for I or tries to enter the legal sector. In the illegal sector of the host country, I appropriates the product of $M's$ work up to p_2; M receives the residual. The total payoff of M when staying in the illegal sector (index "i") is thus:

$$U_i^M = a - p_1 + \widetilde{w} - p_2,$$

where $\widetilde{w}$ is the M's wage in the illegal sector. The payoff of I is:

$$U_i^I = p_1 + p_2 - C.$$

If M tries to receive legal status, there are benefits and costs. When the move is successful, M's wage increases from $\widetilde{w}$ to w. As the legal system protects him against coercion by I, M then reneges on the payment of p_2. On the cost side, M increases his risk of deportation. We normalize the deportation risk in the illegal sector to nil, and label D the deportation risk when applying for legal status. Probability D is the second policy variable of the model. Stricter deportation policies increase D.

If M applies for legal status, his payoff is as follows (indices "l" if M receives legal status, "d" if he is deported to the source country):

$$U^M = U_l^M \equiv a - p_1 + w, \quad \text{with probability } 1 - D,$$
$$U^M = U_d^M \equiv a - p_1, \qquad \text{with probability } D.$$

If M becomes a legal resident, he defaults on his debt and receives his full legal wage. If deported, M receives $a - p_1$: he cannot pay p_2 and does not receive any labor income. For the sake of simplicity, we assume that migration and deportation take up all M's time so he forgoes the home country wage ω. One could also consider a model where M would

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[2]It does not matter whether or not the intermediary is integrated with sweatshops. The migrant's debt and hence his workforce can be "sold" or "rented" to a business partner. This is modeled in Section 6.
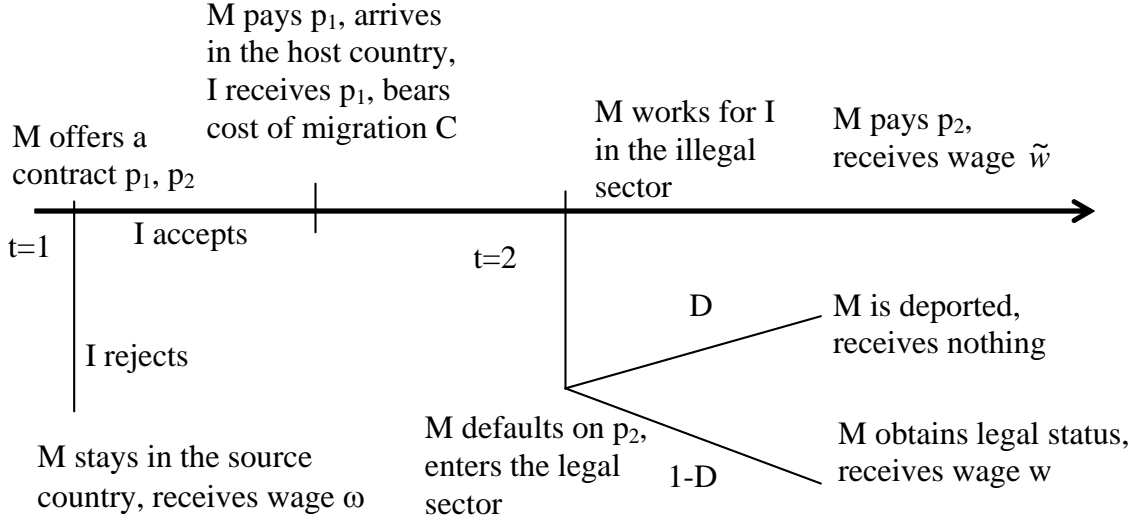
Figure 1: Timing.

still be able to earn some wage at home upon deportation; the results would not change qualitatively.

The respective payoffs for I are:

$$U_l^I = U_d^I = p_1 - C,$$

because whenever M attempts to move to the legal sector, I does not receive p_2, while, at this stage, the cost of immigration C has already been sunk.

3.2 Assumptions on wealth and returns to skills

We here make some simplifying assumptions. There are only two types of migrants, high- and low-skilled, and skill levels are public knowledge. We assume the simplest possible returns to skills:

$$\omega = \begin{cases} \omega^H, & \text{if } a \geq C \\ \omega^L, & \text{if } a < C \end{cases}, \ \omega^H > \omega^L;$$

and

$$w = \begin{cases} w^H, & \text{if } a \geq C \\ w^L, & \text{if } a < C \end{cases}, \ w^H > w^L.$$

Wealth and skills are perfectly correlated. If M has $a \geq C$ ($a < C$) cash, he has high (low) skills, that is, high-skilled workers have enough cash to finance their migration, while

low-skilled workers do not. Also, workers who are high- (low-) skilled in one country, are high- (low-) skilled in the other country as well. In Section 5, we show that our results hold qualitatively under relaxed assumptions about wealth/skill correlations.

We further assume that in the illegal sector of the host country, the skill premium is nil. That is, $\widetilde{w}$ does not depend on whether $\omega = \omega^H$ or $\omega = \omega^L$. More generally, one can assume that the sensitivity of wage with respect to skills is larger in the legal sector than in the illegal sector. This leads qualitatively to the same results. The assumption reflects the fact that irrespective of their skills, illegal workers usually work in low-skilled jobs, for instance, in the garment industry or restaurants (Kwong, 2001). By definition, illegal jobs are in such sectors because large and capital-intensive firms cannot operate illegally.

4   Equilibrium migration and policy effects

As a benchmark, we first look at the case in which there is no intermediary. Here, M must pay the cost of migration upfront, that is, the contract space degenerates to: $p_1 = C$ and $p_2 = 0$. Under our assumptions, a low-skilled M $(a < C)$ cannot migrate because the liquidity constraint is binding. Furthermore, if

$$\widetilde{w} - C < \omega^H, \tag{1}$$

high-skilled workers $(a > C)$ are not interested in migrating to stay in the illegal sector. In what follows we assume for simplicity that condition (1) holds. To check whether high-skilled workers migrate in order to try attaining legal status, we compare $(1 - D)U_l^M + DU_d^M$ with U_s^M. This leads to a simple condition: migration only occurs if

$$(1 - D)w^H > \omega^H + C. \tag{2}$$

The left-hand side (LHS) represents the expected wage in the legal sector (with probability D, M is deported home), and the RHS is a skilled worker's payoff when staying in the source country. Summarizing, in this benchmark, only the wealthier individuals migrate, and the policy effects are as expected. When D or C increase, migration occurs for a narrower set of parameters $a, \widetilde{w}, w^i$. We look now at the equilibrium with intermediaries and obtain the first Proposition.

Proposition 1 *Assume that condition (1) holds (i.e. the high-skilled workers are not interested in migrating and remaining in the illegal sector). Then, equilibrium is as follows:*

1. Low-skilled workers $(a < C)$ migrate if and only if:

$$a \geq C - \left(\widetilde{w} - (1 - D)w^L \right). \tag{3}$$

The migrant does not attempt to move to the legal sector. The contract stipulates p_1, p_2 such that $p_1 \leq a$, $p_2 \geq 0$ and $p_1 + p_2 = C$.

2. *High-skilled workers ($a \geq C$) migrate if and only if (2) holds, and subsequently try to attain legal status. The contract stipulates $p_1 = C$ and $p_2 = 0$.*

3. *No other migration occurs.*

To derive Proposition 1, consider first the migrant's choice. He decides whether or not to migrate, and whether or not to try moving from the illegal to the legal sector subsequently. We thus look at M's payoffs for the three outcomes: "stay in the source country" ($U_s^M = a + \omega$), "migrate and work in the illegal sector" ($U_i^M = a - p_1 + \tilde{w} - p_2$), "migrate and apply for legal status" $\left[(1-D)U_l^M + DU_d^M = a - p_1 + (1-D)w \right]$. The migrant maximizes his payoff subject to satisfying I's individual rationality constraint (IR), that is, the expected payoff of I at the time the contract is signed must be larger or equal zero. For high-skilled migrants this does not cause problems. They pay C upfront to the intermediary and subsequently try to attain legal status. To use a parallel from corporate finance, they behave like self-financed entrepreneurs, who migrate if the net present value of migration exceeds the one of staying home. The case of low-skilled workers is more complicated. They can only pay a part of the total cost upfront. The intermediary is hence only willing to finance migration if the migrant does not attempt to move from the illegal to the legal sector. Put differently, the debt/labor contract is "incentive-compatible" if and only if $\tilde{w} - p_2 \geq (1-D)w^L$, i.e.

$$p_2 \leq \tilde{w} - (1-D)w^L. \tag{4}$$

Using another parallel from corporate finance, the liquidity-constrained (low-skilled) migrant behaves like a debt-financed entrepreneur. There is a risk that he defaults on his debt by trying to attain legal status. The term $\tilde{w} - (1-D)w^L$ represents the value of the "pledgeable income" in the debt contract between M and I. Pledgeable income (see Tirole, 2001) is the maximum amount that M can credibly commit to pay back; therefore it is also the maximum amount that I is willing to lend M. Hence, the participation constraint of the intermediary $U^I \geq 0$ is satisfied only if $a + \tilde{w} - (1-D)w^L - C \geq 0$, which is equivalent to (3) stated in the Proposition.

Consider now the effect of changes in policies C and D on immigration of high- and low-skilled workers.

Proposition 2 *Comparative statics.*

1. *An increase in C, i.e., stricter border controls, decreases migration of low-skilled and high-skilled migrants.*

2. *An increase in D, i.e., stricter deportation and legalization rules, (i) increases migration of low-skilled workers, and (ii) decreases migration of high-skilled workers.*

Proposition 2 entails the main policy implication. Unlike in the benchmark, stricter border enforcement and stricter deportation policies are not equivalent when wealth constraints and intermediaries are taken into account. When C increases, the effects on low and high-skilled workers are similar – the value of migration decreases. But, when D increases, the effects are different. The utility of low-skilled upon defaulting on p_2 decreases. Thus the intermediary's individual rationality constraint is satisfied more often. As a result, Condition (3) holds for a larger proportion of the low-skilled, involving that more of them can migrate. However, condition (2) holds for less of the high-skilled, that is, less of them migrate. While the total effect on the flow of migrants is ambiguous, the skill composition deteriorates when D increases. The effect on skill composition of an increase in C is ambiguous, because it reduces the flow of both high- and low-skilled migrants.

5 Empirical consistency

The empirical literature on effects of policies on illegal immigration is rather scarce. This is not surprising as illegal immigration is by definition a clandestine activity and reliable data are hard to obtain. Also, policy changes do not occur in controlled environments. They are endogenous to the inflow of migrants, which makes it quite hard to properly correlate changes in policies with changes in immigrant flows. It is hence not surprising that rather little is known about the effects of the migration policies. Hanson et al. (2002b) show that border controls deter immigration to a limited extent and that they are very costly. Donato et al. (1992) find that the stricter deportation rules and stricter border controls in the framework of the Immigration Reform and Control Act (IRCA) had no significant effect on the flow of migrants. There are a number of studies that look at the effect of legalization on migrants' earnings (for instance, Cobb-Clark and Kossoudji, 2002, Rivera-Batiz, 1999), but there are no studies that investigate how changes in deportation and legalization policies affect migrant flows, which is our main concern.

While it is impossible to run regressions to test our theory, one could try to calibrate the model in order to quantify policy effects. However, there are a number of complications. First, we know very little about the determinants of demand for services of

smugglers and intermediaries. In our model we have abstracted from the problem of estimating demand. The model is set up in partial equilibrium and assumes that workers migrate provided that the net present value of migration is positive and that they have a sufficient amount of wealth to pay the down-payment. These two conditions then identify the range of parameters in which migration is, in principle, possible and to show how this feasibility set is affected by border controls and deportation policies. These statements are theoretically precise, but to give empirical predictions, we would need to know demand elasticities. Second, policies chosen by governments are endogenous to the amount of migrants, their origin and the skill composition.

We therefore cannot generate full-fledged policy simulations; but we can use data from the US to investigate the empirical consistency of the model: First, our theory hinges on the idea that intermediaries will only deal with migrants who can be expected to respect the terms of the contract, i.e., those for whom the contract is incentive-compatible, see (4). We can check whether this theoretical centerpiece of our model makes empirical sense. Second, our model is based on the presumption that market transparency protects migrants from exploitation by intermediaries. We investigate this as well.

For the consistency check of the migrant's IC constraint, $(\widetilde{w} - p_2) \geq (1 - D)w$,[3] we proceed as follows. We use various sources about the magnitude of the parameters $(\widetilde{w}, p_2, w)$ and then look at what they imply for the remaining parameter we have no estimates for: D, the deportation probability migrants face when attempting to become legalized. Defining D^o as the smallest D for which the IC is satisfied, we can write $D^o = (p_2 + w - \widetilde{w})/w$.

It is useful to first express the wage in the legal sector as $w = (1+l)\widetilde{w}$, i.e., as the wage the migrant receives when staying in the illegal sector plus a premium l associated with legalization. The empirical equivalent of $\widetilde{w}$ is the NPV of working illegally in the U.S. We compute the NPV by taking the average minimum wage in the U.S., \$6.15 per hour (U.S. Dept of Labor, 2005). This is a reasonable estimate of the average market wage of illegal migrants in industries as garment, restaurant or other services. We assume that a migrant works 45 hours for 52 weeks per year over a period of 40 years.

For l, we use Cobb-Clark and Kossoudji's (2002) estimates of 14 to 24% legalization premia. They have looked at Mexican immigrants, and skill premia may be different for Chinese and other long-haul immigrants, who may have different skill distributions. Nonetheless, to our knowledge, these are the best available proxies. Debt repayment p_2 can be assumed to be between \$25,000 and \$35,000, as immigrants usually pay around

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[3]Notice that in the basic model, only low-skilled migrants would enter a debt/labor contract, we can hence omit the index L.

20% of the total cost of migration as down-payment (Chin, 1999).

We have run simulations using different interest rates. The estimates for D^o are in the range between 7.5% (assuming an interest rate of 3% for the NPV, p_2 of \$25,000, and zero legalization premium) and 28% (5%, \$35,000, and a legalization premium of 24%). The scenario that seems most realistic to us yields a D^o of 19% (5%, \$25,000, 14%). These estimates seem sensible; moreover, the simulation results show that our theory would be empirically testable if we had data on the deportation risk of migrants who move out of the shadow.

As for the second consistency check, it is difficult to judge to what extent the average smuggling fee (30 to 50 thousand US dollars) reflects some market power. However, we can use the figures we have collected to check whether – as our theory assumes – reputational concerns keep smugglers from exploiting migrants "too much" *ex post*. In order to do so, notice that the average migrant from China pays back his or her debt of \$25,000 to \$35,000 in 26 months; the maximum length of debt repayment we know about is four years (Chin, 1999). Assuming as before that a migrant works 45 hours per week and at the minimum wage of \$6.15, the value of this work would be around \$31,000 for 26 months and \$58,000 for four years. Taking into account the value of (low-quality) food and housing that migrants receive while paying back their debt, these figures do not indicate much exploitation.

Last but not the least we should verify whether migrants' acceptance of debt/labor contracts is rational. Estimates of the GDP per capita in China in terms of purchasing power parity are in the range of \$4000 (e.g. CIA World Factbook, 2005). This implies that the net present value of migration, even taking into account the wages at home and the costs of migration, is large – about 180 thousand US dollars.

6   Theoretical robustness, extensions

Our theory builds on two crucial assumptions. First, we assume that when an illegal immigrant tries to acquire legal status, he increases his risks of being deported. In Assumption 1 of the model, we have normalized the deportation risk in the illegal sector to nil. This is not necessary for the model to hold. It suffices that stricter deportation policies increase the deportation risk from the legal sector to a larger extent than from the illegal sector. Otherwise, they would not decrease migrants' incentives to default on debt repayments. The effect of stricter border controls and stricter deportation policies would then be equivalent.

Assumption 1 makes sense for a number of reasons. Moving from the illegal to the legal

sector makes migrants more visible and vulnerable. They have to register with government agencies, which increases the risks of deportation. Furthermore, in the absence of raids on employers, the chances to detect illegal immigrants are very low, unless they get in contact with the legal sector. Section 7 models work-site inspections explicitly.

The second major assumption is that debt/labor contracts cannot be enforced in the legal sector. In subsection 6.1 we show that our model is robust to allowing for the possibility of debt collection in the legal sector. In 6.2, we sketch a generalized model that does not hinge on assumptions concerning the correlation of skills and wealth, or on specific distributions. In 6.3, we briefly look at direct legal entry into the host country, and in 6.4 at the allocation of bargaining power between workers, smugglers and employers of illegal migrants.

6.1 Debt collection in the legal sector

According to Assumption 2, debt p_2 can only be collected in the illegal sector. Assume now that there is some possibility of debt collection, even if M transits successfully to the legal sector. As the legal system of the host country provides protection for M, debt collection is then more costly for the intermediary. One could model default and potential debt collection between M and I as an explicit game. Here we focus on checking robustness only. Hence, it is sufficient to look at a reduced form and to simply assume that debt is collected in the legal system with probability $\xi \in [0, 1]$.

Then, omitting index L at the legal-sector wage w, M's incentive-compatibility constraint becomes less restrictive:

$$(\widetilde{w} - p_2) \geq (1 - D)(w - \xi p_2).$$

The pledgeable-income constraint (4) is rewritten as follows:

$$p_2 \leq \frac{\widetilde{w} - (1 - D)w}{1 - (1 - D)\xi}.$$

The wealth constraint of the migrant is still $p_1 \leq a$, and the intermediary's participation constraint is:

$$p_1 + p_2 \geq C.$$

Adding up the three inequalities, we find that debt-financed migration is feasible whenever:

$$C \leq a + \frac{\widetilde{w} - (1 - D)w}{1 - (1 - D)\xi}. \tag{5}$$

The right-hand side of (5) increases in D, because $w > \widetilde{w} \geq \widetilde{w}\xi$. Hence, our main result remains intact: stricter deportation policies facilitate debt-financed migration.

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Further, the intermediary does not let the migrant go to collect debt from their wage in the legal sector if the following holds:[4]

$$a + w(1 - D)\xi < C. \tag{6}$$

That is, for ξ sufficiently low such that (6) is satisfied, stricter deportation policies increase migration. Conversely, if (6) does not hold, I would let M go to work in the legal sector. Given the well-documented debt-labor contracts between intermediaries and migrants, this seems to be rarely the case.

6.2 Generalized model

We now consider a continuum of workers and skills; we also drop the assumption of perfect correlation between skills and wealth. These changes are useful to check robustness of the comparison of stricter border controls *vs* stricter deportation policies. They also generate an additional result: stricter border controls may induce illegal migrants to move from self-financed migration to debt/labor contracts.

Assume that the source country is populated with a continuum of workers whose mass is normalized to 1. The workers differ in three dimensions: home wage ω, wealth a, and wage in the legal sector w. All three parameters are likely to be correlated with the skills of workers; therefore they should be positively correlated with each other. We do not make any specific assumptions about the joint distribution of the parameters; rather we allow for some joint density function $f(\omega, a, w)$ on R_+^3. For simplicity, we maintain the assumption that there is no skill premium in the illegal sector ($\widetilde{w}$ is the same for all workers). Relaxing this assumption would not change the results, but would generate economically uninteresting distinctions.

The analysis is similar to that of Section 4. Lemma 1 (in the Appendix) states the precise expressions for different types of migrant flows. Figure 2 plots these flows as a function of migrant wages w, and initial wealth a, given the wage at home ω. The left-hand side graph represents the case of relatively skilled workers for whom $\omega + C > \widetilde{w}$, i.e., the wage in the home country plus the cost of migration outweighs the income from working in the host country's illegal sector. Such workers will only migrate in order to transit to the legal sector; therefore only self-financed migration is feasible ($a > C$).[5] Migration pays off whenever $(1 - D)w - C > \omega$ or, equivalently, $w > (\omega + C)/(1 - D)$.

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[4]We thank a referee for pointing to this issue.

[5]As the IC of these migrants is never satisfied, intermediaries cannot break even when doing business with them.
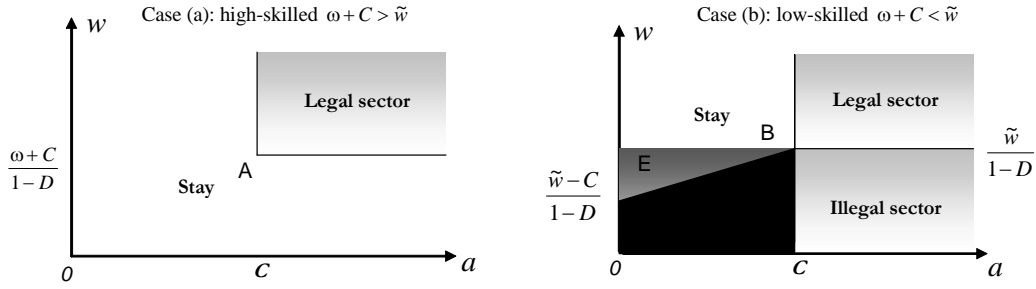
Figure 2: Migration flows in a generalized model as a function of wage at home ω, wealth a, wage in the legal sector w, and wage in the illegal sector $\tilde{w}$.

The right-hand side graph represents relatively low-skilled workers with $\omega + C < \tilde{w}$. Compared to the basic model, new cases emerge when we drop the assumption of perfect correlation between skills and wealth: Relatively low-skilled workers may be sufficiently wealthy ($a \geq C$) to migrate without engaging in a debt/labor contract. Depending on their wages in the legal sector, they either try to transit to the legal sector (northeast of point B), or they stay in the illegal sector (southeast of point B).

For those who are wealth-constrained ($a < C$), the line EB represents the incentive constraint (the pledgeable income equals the amount borrowed $C - a$). Notice that the intermediary only finances wealth-constrained workers with relatively low skills (below E'B'). If the migrant can earn too high a wage in the legal sector, he will default on debt, and the pledgeable income is not sufficient to cover the intermediary's costs.

Comparative statics results can be found in Lemma 2 in the Appendix. First, we look at the impact of stricter border enforcement policies (an increase from C to C'). Such a policy change has effects on: (a) the migration flow of high-skilled workers for whom $\omega + C > \tilde{w}$; (b) the migration flow of low-skilled workers; (c) the proportion of workers with $\omega + C > \tilde{w}$, who only migrate to work in the legal sector, and hence must self-finance migration.

Effect (c) is obvious. Effect (a) is also straightforward. In Fig. 2, left, point A moves northeast and migration decreases. Effect (b) is plotted on the left-hand side of Fig. 3. First, the increase in C directly reduces the flow of self-financed low-skilled migrants. Second, it shifts line EB to the right; this reduces the flow of debt-financed low-skilled. Third, there is an interesting new effect. Area II (below EB) depicts the flow of workers moving from self-financed migration to debt/labor contracts when C increases. Their wealth does not suffice anymore to pay the cost of migration themselves, but the pledgeable income is large enough for the intermediary to break even.
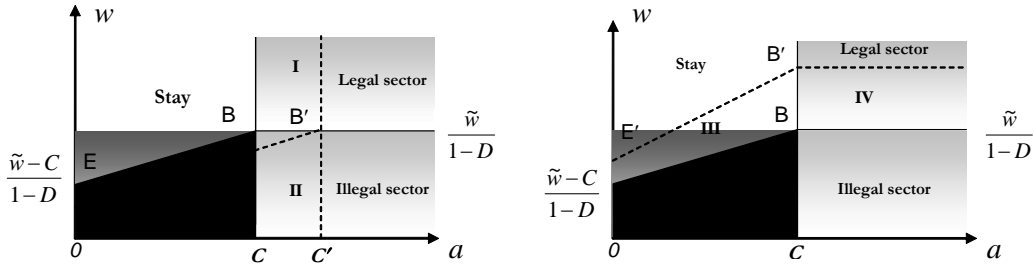
Figure 3: Comparative statics for the low-skilled workers ($\omega + C < \tilde{w}$). The left-hand side graph illustrated the effect of an increase from C to C'; the right hand-side graph shows the impact of an increase in D.

Notice also that while an increase in C reduces the flow of all types of migrants, the effect on skill composition is ambiguous.

Stricter *deportation* policies (an increase of D to D') do not affect condition (1). Thus, there is no shift between the groups of workers for whom $\omega + C > \tilde{w}$ or $\omega + C < \tilde{w}$. Migration of the highly skilled decreases (point A, Fig. 2a, moves northeast). The graph on the right side of Fig. 3 shows the effect on low-skilled. The net present value of migration to the legal sector decreases. Thus, the wealthier low-skilled workers prefer migrating and staying in the illegal sector, rather than trying to transit to the legal sector (area IV).[6] However, when moving to the legal sector becomes less attractive, it is also easier for the intermediary to recover its investment – the pledgeable income of wealth-constrained workers increases. Hence, a greater number of low-skilled workers migrate (area III). As more low-skilled and less high-skilled migrate, migrant skill composition deteriorates.

These comparative statics suggest that the interaction of policies is more subtle than the simple model would suggest. In the framework of the simple model, there is a quick solution to stop migration through debt/labor contracts without changing total inflow of workers. The government could decrease D, and as total immigration increases (owing to more high-skilled immigration), it could increase C to reduce overall migration to the original level. The general model, however, shows that this policy package would fail, because an increase in C creates new debt/labor immigrants.

The following proposition summarizes the above discussion.

Proposition 3 *Effects of policy variables in the generalized model.*

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[6]Notice that a similar effect is discussed in Epstein et al. (1999).

1. *An increase in C reduces migrant flows and has ambiguous effects on the skill composition of migrants.*

2. *An increase in D has ambiguous effects on migrant flows and reduces the average skills of migrants.*

6.3 Legal entry

We have only considered illegal immigration above, but the results are robust to allowing for the direct legal entry. In reality, there are limited possibilities of direct legal entry into the US, for instance, through lotteries, or for very wealthy immigrants: Section 203(b)(5) of the US Immigration and Nationality Act provides permanent resident status for immigrants who invest USD 1 million in the US economy.[7] Suppose that the cost of direct legal entry is L. Wealthy high-skilled workers compare the utility associated with illegal migration and a subsequent attempt to legalize, $a - C + w(1 - D)$, to the utility of direct legal entry, $a - L + w$. Direct legal entry is therefore chosen if:

$$w > (L - C)/D \text{ and } a > L.$$

Therefore the migrants with highest skills and largest wealth will immigrate via direct legal entry. However, types with intermediate wealth and skills choose illegal entry with a plan to acquire legal status after arriving at destination.

6.4 Monopoly power and the role of employers

In the model, migrants have full bargaining power. This has allowed us to identify the largest set of workers for whom migration is feasible (see the comment in Section 5). In reality, intermediaries may have some market power. Furthermore, unlike in our model, smugglers and employers may not maximize joint profit, but they may be vertically separated. This subsection provides an idea how these issues can be handled in the framework of our model.

For simplicity, we keep the assumption of symmetric information and assume that the intermediary is a monopoly. This implies that I, rather than M has all the bargaining power. Suppose also that there are firms who employ the migrant in the illegal sector. They are separate from the intermediary, and it is realistic to assume perfect competition between employers. The smuggler collects p_1 from M and sells the debt claim of p_2 to the

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[7]http://uscis.gov/graphics/services/residency/investment.htm, the U.S. Citizenship and Immigration Service.

employer. If the employer expects the worker to stay in the illegal sector, the employer will be willing to pay p_2 to the smuggler. Otherwise the employer will not pay anything.

Worker M has no bargaining power in the illegal sector, and his outside option of a transit to the competitive legal sector provides a payoff of $(1 - D)w$. The employer's payoff is therefore $\widetilde{w} - (1 - D)w$. This is also the maximum amount the employer would want to pay for the debt claim. Hence $p_2 \leq \widetilde{w} - (1 - D)w$, very much like in the simple model above. As I's rent is $p_1 + p_2 - C$ must be positive, and the financial constraint implies $p_1 \leq a$, we have the same constraint for the feasibility of debt-financed migration as before: $\widetilde{w} - (1 - D)w + a \geq C$.

The smuggler will set p_1 to make M's participation constraint $a - p_1 + (1 - D)w - \omega \geq 0$ binding. In contrast to the model in Section 3, all rents are now appropriated by I. However, the effect of policy variable D is the same. When D increases, I decreases p_1 to keep workers interest in migrating (i.e., $-p_1 + (1 - D)w$ is kept constant). However, the increase in D involves that $\widetilde{w} - (1 - D)w + a \geq C$ holds for a smaller number of workers.

The sketch of analysis above is only a first step for studying vertical integration and separation, and the issue of market power between smugglers and employers. More interesting trade-offs may be generated when one introduces asymmetric information, contractual incompleteness, and specific investments. Yet, given how little evidence there is on the relationship between smugglers and employers, we prefer not to speculate on those issues in this paper.

7 Employer sanctions

In the U.S., work-site inspections are rarely carried out and employer sanctions tend to have little bite. According to Hanson et al. (2002a), in 1990, less than eight percent of INS enforcement manpower was devoted to worksite inspections, and less then one percent of the 1.5 million apprehensions were made at worksites. A report of the U.S. Department of Justice (1996) stated that:

> "[e]ven if the illegal alien work force in the U.S. were to remain static at 2 million and INS were to meet its removal targets, INS worksite removals would equal less then 0.1 percent of the illegal alien work force and could be expected to have a statistically insignificant effect on the remaining work force."

Although government officials occasionally announce a tougher stance on employers, little appears to have changed since then. The situation is similar in the UK. The IOM

(2003) reports that the number of UK employers who were fined under the "Asylum and Immigration Act" of 1996 were nil in 1997, one in 1998, nine in 1999, and 23 in 2000.

The situation is different in continental Europe. According to Martin and Miller (2000), sanctions in France and Germany are much stricter than in the US. In France, for instance, employers can be penalized to up to 1000 times the minimum wage (1286 Euros in 2004), while in the U.S. the maximum fine is $10,000. Germany spends about five times more per worker than the US to prevent the employment of illegal foreign workers. Germany has about 1,500 labor market inspectors for a labor market with about 40 million workers, in 1994, the US had 245 INS worksite investigators (and an additional 900 Department of labor inspectors) for about 130 million workers. In France and Germany, labor inspectors can inspect any site without prior notification. In the US they must give advance notice of three days.

Given high unemployment in many European countries, it can be expected that employer sanctions and inspections will be intensified. The model can be readily extended to take into account employer sanctions. They have similar effects as increases in border enforcement. Furthermore, we have conjectured before that stricter deportation policies can only have deterrent effects on illegal migrants if raids on employers of illegal migrants are intensified. We here show formally the existence of such complementarities.

Suppose first that in the illegal sector, there is a probability E of a raid. Then, the worker is deported to the source country, and the employer is fined for F dollars. In this case worker automatically defaults on debt.

The worker's payoff in the illegal sector is therefore:

$$U_i^M = a - p_1 + (1 - E)(\widetilde{w} - p_2).$$

The payoff of I (denoting the coalition of smuggler and employer) has a payoff of:

$$U_i^I = p_1 + (1 - E)p_2 - C - EF.$$

The worker's incentive compatibility constraint becomes:

$$a - p_1 + (1 - E)(\widetilde{w} - p_2) \geq a - p_1 + (1 - D)w.$$

Adding up the liquidity constraint $p_1 \leq a$, we obtain $p_1 + p_2(1 - E) \leq a + \widetilde{w}(1 - E) - w(1 - D)$. Therefore the participation constraint $U_i^I \geq 0$ implies:

$$a \geq C - (\widetilde{w} - (1 - D)w) + E(\widetilde{w} + F). \tag{7}$$

Raids E and harshness of punisment F have similar effects on debt-financed migration as C. The stricter these employer sanctions, the lower debt-financed migration. Yet, the

impact of D is unaffected. Stricter deportation policies facilitate debt-financed migration (holding border enforcement C, employer raids E, and employer sanctions F constant).[8]

Consider now a more sophisticated and probably a more realistic setting in which there exist complementarities between D and E. Assume that the same deportation policy is applied to both those applying for legal status and those caught in work-site inspections. Then the probability of being detected and sent home associated with a job in the illegal sector is $E = \widehat{E}D$, and the policymaker chooses $\widehat{E}$ rather than E. The pledgeable income becomes $\left(1 - \widehat{E}D\right)\widetilde{w} - (1 - D)w$. Hence debt-financed migration occurs if:

$$a \geq C + \widehat{E}D(\widetilde{w} + F) - \widetilde{w} + (1 - D)w. \tag{8}$$

In this framework, the effect of stricter deportation policies on the pledgeable income $-\widetilde{w}\widehat{E} + w$ is weaker, but it remains positive. As the legal sector wage $w > \widetilde{w} \geq \widehat{E}\widetilde{w}$, stricter deportation policies still facilitate migration.

Proposition 4 *In a model with employer sanctions, the impact of policy is as follows*

1. *Stricter border enforcement C and stricter employer sanctions $\widehat{E}$ decrease illegal debt-financed migration.*

2. *Stricter deportation policy D increases illegal debt-financed migration.*

3. *Stricter employer sanctions $\widehat{E}$ weaken the positive effect of deportation policy D on debt-financed migration.*

The last statement essentially emphasizes the complementarities between policies. Without employer sanctions, stricter deportation promotes debt-financed migration and decreases self-financed migration, so the total effect may be positive or negative. However, the stronger the employer sanctions, the less important is the positive effect of deportation policy on debt-financed migration. Hence, deportation policies become a more effective tool for decreasing migration. This result is in line with Ethier (1986) and more recent work, for instance, Chau (2001) who argue that policy instruments should be combined to be effective.

8 Further implications

Our model can provide some insights about the effect of *amnesties* on decisions to migrate. The existing literature on amnesties (e.g. Chau, 2001, and Epstein and Weiss,

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[8]If D and E are changed together (e.g. increase by the same amount), then the stricter policies do deter migration as long as the employer sanctions are strict enough ($F > \widetilde{w} - w$).

2001) does not consider financial constraints. Therefore, since each amnesty raises expectations for future amnesties, it results in higher incentives to migrate. This is true in the model when only self-financed migration is considered. Indeed, if *ex ante* both migrants and intermediaries anticipate a sufficiently high chance of amnesty (lower D, in terms of our model), then high-skilled migration should increase (Part 2 of Proposition 2). However, once one takes into account the impact of expected amnesties on the debt/labor contract, a countervailing effect arises. Anticipating that immigrants may obtain legal status through amnesty, intermediaries will refuse to lend. Hence, more of the wealth-constrained migrants stay in the source country, which decreases low-skilled migration. Thus, an expected amnesty may either increase or decrease total immigration, but it improves the skill composition of incoming migrants.

Our model takes a positive perspective. We abstain from welfare statements as the welfare analysis is very complicated. It is in the interest of wealth-constrained immigrants to engage in debt/labor contracts, because they could not migrate otherwise.[9] Lenient deportation policies can hence reduce the joint welfare of immigrants and the host country. However, this does not take into account a number of external effects: (i) the negative impact of high-skilled emigration on the source country ('brain drain'); (ii) the impact of immigration on the low-skilled domestic workers whose retraining is costly and take time[10]; (iii) the impact of lenient deportation policies on the stock of illegal immigrants who have already entered the country; (iv) the ethical concerns that sweatshops and illegal immigration raise, and the risk that the law enforcement system is corrupted. The welfare analysis becomes even more involved in the case of immigration amnesties which are hard to study in a static framework.

We have throughout the paper made a distinction between human smuggling, which assumes rational contracting between intermediary and migrants, and *trafficking* that involves manipulation and coercion. While we want to be careful to expand the model's reach to trafficking, it seems that more lenient deportation policies are more desirable, because they help trafficking victims and reduce the profitability of trafficking networks. While the *ex ante* analysis of our model does not hold for trafficking victims, the profitability of the trafficking industry depends to a similar extent on the strictness of deportation rules as the one of the smuggling industry. Hence there are similar implications, provided

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[9]In our model, servitude is voluntary. Stricter deportation policies that facilitate debt-labor migration therefore benefit immigrants. As argued in Genicot (2002), it is quite hard to construct an economic argument where voluntary bonded labor is against the worker's interest, unless one introduces externalities in credit markets.

[10]These workers do not want low-skilled immigration, but may benefit from high-skilled immigration, see Zimmermann (1994).

that the victims of trafficking have some possibility to escape and contact the police. Our logic does not apply otherwise.

While illegal migration is a relatively new phenomenon by historical standards, it bears resemblance with the past. Past migration waves were driven by income differentials in similar ways as current migration. It has always been expensive to migrate, and migrants have always been subject to financial constraints.[11] What distinguishes the present wave of migration from the previous ones is that, nowadays, host country governments undertake efforts to deter rather than to encourage migration.

There are nonetheless striking parallels to *indentured servitude*. Between one half and two thirds of all white immigrants coming to the Northern American British Colonies between 1630 and the Revolution came as indentured servants. To finance the passage to the colonies, they committed their workforce for a certain period of time (Galenson, 1984). Initially, a vertically integrated company provided finance and transportation, and owned workshops employing the immigrants. Later, this industry converged to a structure similar to the one observed in the modern world; the company only provided finance and transportation but then sold the debt claim, and hence migrants' workforce to independent employers in the colonies. Debtholders respected the terms of contracts and set workers free after they had paid their debt. Usually this took three to seven years. Many indentured servants tried to run away, but as the contracts between migrants and debtholders were fully legal, captured servants were penalized and sent back to the debtholders. This made sense since the government was interested in an inflow of cheap labor. In terms of our theory, the host country could not further decrease the cost of migration C (it was dictated by high relative transportation costs rather then by policy-driven barriers), so the only way to increase immigration was to enforce debt/labor contracts and sustain indentured servitude as a labor market institution.

The main difference between indentured servitude and modern sweatshop employment is that today's host countries do want to combat illegal migration. Our model shows, however, that by applying stricter immigration policies, they may contribute to the spread of debt/labor contracts. First, stricter border and visa policies increase cost of entry and make financial constraints binding for a greater number of potential immigrants. Second, stricter deportation policies help enforce debt/labor contracts in a way similar to that of the British colonies in the 17th and 18th centuries.

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[11]See Chiswick and Hatton (2002) and O'Rourke and Williamson (1999) for an overview on current and past migration.

9 Concluding remarks

The rather poor data situation does not yet allow to carry out a comprehensive empirical evaluation of immigration policies. There is thus scope for theoretical analysis to better understand the effects of different policies, and the costs that may be associated with them. We have presented a theory of illegal immigration in which the interaction between migrants and intermediaries is crucial.

In this realistic framework stricter border controls and stricter deportation policies do not affect the flow and composition of illegal immigration in similar ways. While stricter border controls reduce migrant flows and have ambiguous effects on skill composition, stricter deportation policies have ambiguous effects on flows, but unambiguously worsen skill composition. We have also shown that stricter border controls may induce migrants to move from self-financed migration to temporary servitude, and that there can be complementarities between deportation policies and worksite inspections. These effects arise in a straightforward way once financial constraints and the role of intermediaries are considered, and they seem to be in line with the existing empirical evidence.

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Appendix: Comparative Statics in the Generalized Model

Straightforward calculations yield the following Lemmas.

Lemma 1 *Equilibrium migration flows under the assumptions of Section 6.2 are as follows.*

1. Inflow of migrants, financed through a debt/labor contract, staying in the illegal sector:

$$n^i_{debt} = \int\limits_0^C da \int\limits_0^{\widetilde{w}-C} d\omega \int\limits_0^{\frac{\widetilde{w}+a-C}{1-D}} f(\omega, a, w)dw.$$

2. Inflow of self-financed migrants, trying to move to the legal sector:

$$n^l_{self} = \int\limits_C^\infty da \int\limits_0^\infty d\omega \int\limits_{\frac{\max\{\widetilde{w},\omega+C\}}{1-D}}^\infty f(\omega, a, w)dw.$$

3. Inflow of self-financed migrants, staying in the illegal sector:

$$n^i_{self} = \int\limits_C^\infty da \int\limits_0^{\widetilde{w}-C} d\omega \int\limits_0^{\frac{\widetilde{w}}{1-D}} f(\omega, a, w)dw.$$

Indices "debt" and "self" represent sources of financing; indices "l" and "i" stand for legal and illegal sector.

Lemma 2 *Comparative statics.*

1. An increase in C decreases both legal and illegal migration, decreases self-financed migration. The effect on debt-financed migration is ambigous.

$$\frac{\partial n^l_{self}}{\partial C} < 0; \quad \frac{\partial \left(n^i_{debt} + n^i_{self} \right)}{\partial C} < 0; \quad \frac{\partial \left(n^i_{self} + n^l_{self} \right)}{\partial C} < 0.$$

2. An increase in D decreases legal migration, decreases self-financed migration, but increases illegal migration, both debt-financed and self-financed.

$$\frac{\partial n^l_{self}}{\partial D} < 0; \quad \frac{\partial \left(n^l_{self} + n^i_{self} \right)}{\partial D} > 0;$$
$$\frac{\partial n^i_{debt}}{\partial D} > 0; \quad \frac{\partial n^i_{self}}{\partial D} > 0.$$