

Migrants in Debt

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Abstract

Numerous studies suggest that illegal immigration in the form of bonded labor is becoming an increasingly important phenomenon. This paper develops a simple model of optimizing behavior of undocumented immigrants who are employed in the host country as bonded laborers while repaying their debts to human smugglers. The analysis relates the optimal duration of the repayment period and the migrant's consumption behavior to the stock of debt, the rate of interest charged by the smuggler and the levels of the bonded and free-market wages in the destination country. This provides a framework for examining the effectiveness of immigration controls, internal enforcement measures and deportation policies of the host country in deterring debt-bonded migration.

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Key Words: Illegal immigration, bonded labor, human smuggling.

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1 Introduction

New barriers to international migration of low skilled workers along with an increasing supply of willing migrants are contributing to the expansion of illegal immigration and rapid growth of illicit enterprises specialized in moving humans across international borders.¹ In spite of the rather competitive nature of smuggling organizations, the cost of migration is now reaching \$20'000 - \$40'000 on certain routes. Such amounts are often far beyond the volume of savings that potential migrants can accumulate on their own or with the support of family and friends. When the migrants are unable to pay for the cost of passage, in many cases they choose to become indebted to the smugglers.

During the period of indebtedness, a migrant is usually dispossessed of identity documents and deprived of basic rights, including the freedom of movement or the possibility of changing jobs. From the point of view of the smuggler, there is the risk that the migrant might be deported, become disabled, or even run away without repaying the loan. In order to minimize the likelihood of default, the smuggler literally holds on to the migrant by arranging employment with a partner organization which channels the loan repayment directly to the smuggler. The rates of interest charged on such loans are reported to be excessive, often 30, 50 or even 120% per annum, while the bonded wage paid by the employer during the period of indebtedness is lower than the market wage in a similar occupation.²

With these key features, the relationship between the smuggler and the migrant takes on the appearance of a forced-labor arrangement. Nonetheless, there is evidence that the vast majority of debt-bonded migrants are behaving rationally, well aware of the

¹There is a vast theoretical literature on illegal immigration, starting with the work of Ethier (1986) and including the contributions by Djajić (1987, 1997), Epstein, Hillman, and Weiss (1999), Gaytan-Fregoso and Lahiri (2000), Woodland and Yoshida (2006), and Auriol and Mesnard (2010). For an excellent survey of the literature see Hanson (2006) and the paper's extensive list of references to both theoretical and empirical work on this subject.

²See Kwong (1997), Gao (2004), and Gao and Poisson (2005). Human Rights Watch (2000) provides extensive evidence on the experience of debt-bonded Thai sex workers in Japan. The wage they earn from their employers is noted to be higher once they pay off the debt.

fees and conditions of employment at destination before entering into verbal agreements or signed contracts with a smuggling organization (see Skeldon (2000) and Sobieszczyk (2000)). The purpose of our study is to examine a migrant's optimizing behavior under this arrangement and what it implies for the effectiveness of immigration-policy measures of the host country. The problem of trafficking, which involves deception, coercion, abuse and even violence, is not addressed in this paper.³

While there are numerous descriptive studies of indebted migrant workers and the nature of their relationship with the smuggling and trafficking organizations (see, e.g., Gao (2004), and Gao and Poisson (2005), Human Rights Watch (2000), Kwong (1997), Salt (2000), Skeldon (2000), Sobieszczyk (2000), Stein (2003), Surtees (2003), and Vayrynan (2003)), very little theoretical work has been done on this subject.⁴ Moreover, to this point, the optimization problem of a debt-bonded migrant has not been examined in detail. The present study takes a step in this direction, not only for the sake of improving our understanding of the behavior of such migrants, but also because it is essential in providing a microeconomic foundation for the analysis of policies aimed at deterring this form of international labor mobility. Debt bondage is viewed today as a particularly cruel and exploitative arrangement, akin to modern-day slavery (see humantrafficking.org (2011)). It is a stated objective of governments all over the world to

³It is important to emphasize the distinction between human smuggling and human trafficking, which is often blurred in the media. Human trafficking involves transporting individuals from one place to another either against their will or under a false pretence. It is a violation of basic human rights, can occur across and/or within borders, and starts when one party deprives another of the freedom of choice by using threats, force, coercion, deception or fraud for the purpose of exploitation (see FAITC (2011)). Human smuggling, on the other hand, generally takes place with the consent of the person being smuggled. The vast majority of illegal immigrants are smuggled, rather than trafficked to their destinations. The number of immigrants smuggled from Mexico into the U.S.A. is upwards of 350,000 per year, while the State Department estimates that 14,500 to 17,500 people, primarily women and children, are trafficked annually into the U.S.A. (see humantrafficking.org (2011)).

⁴Tamura (2010) provides a pioneering theoretical analysis of migrant exploitation by smugglers. In contrast with our model, however, he assumes that migrants are not indebted. They pay the smuggling fee in full out of initial asset holdings at the time of arrival. A recent empirical study by Mahmoud and Trebesch (2010) examines the factors that influence the incidence of trafficking within a migrant population, although their data does not distinguish between direct pay and debt-bonded migrants.

deter the use of such contracts, especially when they form the basis for funding clandestine immigration (see Trafficking in Persons Report (2010)).

To the best of our knowledge, a recent paper by Friebel and Guriev (2006) is the first to explicitly consider debt-financed migration. It examines the interaction between wealth-constrained migrants and human smugglers, with a focus on the conditions under which smugglers are willing to offer credit to their clients. This provides the basis for the evaluation of the impact of various policy measures on the volume of debt-bonded and self-financed migration. One of their key assumptions is that a human smuggler (i.e., the creditor) faces a higher risk of default if the migrant tries to transit from the illegal to the legal sector of the host country. Such an attempt, however, puts the migrant at risk of deportation. Friebel and Guriev show that, by deterring attempts to transit to the legal sector (and thereby default on a loan), tougher deportation measures result in a larger pool of potential migrants being offered credit by the smugglers. In the context of their model, this increases the incidence of debt-bonded migration. In the present paper we assume, instead, that a migrant has no scope for defaulting on the loan, so that immigration policies of the host country do not affect his *access* to credit, although they do affect his decision to migrate.

Another key distinction between our model and that of Friebel and Guriev (2006), is that we introduce time explicitly into the analysis. Thus the payoff is not realized by the migrant immediately on arrival in the host country, but over a finite horizon which consists of two or more phases with endogenously-determined durations. This allows us to examine the impact of changes in the conditions facing a migrant on the duration of the debt-repayment phase, the debt-free phase in the host country, and a possible third phase back in the source country in case of deportation. Changes in immigration policies affect the length of each phase and, therefore, a migrant's discounted lifetime utility and the choice between migrating or remaining permanently at home. In this manner we are able to examine the effectiveness of various policy measures in deterring debt-bonded

migration within a framework that is in several dimensions richer than that developed by Friebe and Guriev.

The basic problem confronting a migrant in debt is defined in Section 2. Section 3 examines a migrant's optimal response to changes in the conditions while in bondage and after debt repayment. We focus on how the stock of debt, the interest rate charged by the smuggler, and the differential between the bonded and free-market wage affect the duration of the optimal loan-repayment period and the time profile of his consumption. Section 4 introduces the possibility of deportation into the model, which is found to lower a migrant's consumption rate both in bondage and after release. It also results in a more rapid repayment of the loan with the speed of repayment depending on the intensity of internal enforcement measures and the degree to which the smuggling organization is able to shield an indebted migrant from deportation. Section 5 looks at the relationship among the key policy variables that must be in place to render debt-bonded migration unattractive for a potential migrant. Finally, Section 6 concludes the paper by summarizing the main results.

2 Debt-Bonded Migration

A debt-bonded migrant seeks to maximize utility from consumption over a planning horizon which is assumed to last from time 0 to T . At $t = 0$ he is smuggled into the destination country, where he stays until the end of his life cycle at $t = T$. With initial wealth assumed to be nil, he borrows from the smuggler to cover the cost of migration, agreeing to provide his labor as collateral. The amount of the debt is denoted by D and the interest rate charged by the smuggler, r , is assumed to be greater than r^* , the risk-free rate in the destination country. While indebted, the migrant works for an enterprise connected to the smuggling organization and earns the bonded wage w^b . Once the migrant repays the debt, he is released from bondage and free to earn the free-

market wage, $w^* > w^b$. Following Ethier (1986), we initially assume that the probability of deportation, both in bondage and after release is nil.

The problem of the migrant is to choose the duration of the debt repayment period, τ , his consumption while indebted, c_t^b , and after being released from bondage, c_t^* , given his rate of time preference, δ , wage rates, w^b and w^* , size of the debt, D , and the interest rates, r^* and r . We assume that δ , w^* , w^b , r^* , r , and D are all constant and the price level is normalized to 1.

The migrant maximizes his objective function,

$$V = \int_0^\tau u(c_t^b)e^{-\delta t} dt + \int_\tau^T u(c_t^*)e^{-\delta t} dt, \quad (1)$$

subject to two budget constraints. First, during the period of indebtedness, his savings, discounted at the interest rate r , must sum up to the amount of the debt.⁵

$$\int_0^\tau (w^b - c_t^b)e^{-rt} dt = D. \quad (2)$$

Second, over the post-indebtedness period, his net savings, discounted at the risk-free rate r^* , must be equal to zero:

$$\int_\tau^T (w^* - c_t^*)e^{-r^*t} dt = 0. \quad (3)$$

The Lagrangian function is given by

$$L = \int_0^\tau u(c_t^b)e^{-\delta t} dt + \int_\tau^T u(c_t^*)e^{-\delta t} dt + \lambda \left[\int_0^\tau (w^b - c_t^b)e^{-rt} dt - D \right] + \mu \int_\tau^T (w^* - c_t^*)e^{-r^*t} dt,$$

with the first-order conditions:

$$\frac{\partial L}{\partial c_t^b} = u'(c_t^b)e^{-\delta t} - \lambda e^{-rt} = 0, \quad (4)$$

$$\frac{\partial L}{\partial c_t^*} = u'(c_t^*)e^{-\delta t} - \mu e^{-r^*t} = 0, \quad (5)$$

$$\frac{\partial L}{\partial \tau} = u(c_\tau^b)e^{-\delta\tau} - u(c_\tau^*)e^{-\delta\tau} + \lambda(w^b - c_\tau^b)e^{-r\tau} - \mu(w^* - c_\tau^*)e^{-r^*\tau} = 0 \quad (6)$$

⁵The need to accumulate a certain amount of savings abroad before the next phase of the planning horizon is an element that our model has in common with that of Mesnard (2004). She examines the behavior of migrants who aim to save a certain amount abroad in order to invest in a business after return. She assumes, however, that the rates of interest and time preference are zero, which in the present setting would render the problem both unrealistic and trivial.

and the budget constraints (2) and (3). These five equations determine the five endogenous variables c_t^b , c_t^* , τ , λ , and μ . Equations (4) - (5) relate the marginal utilities of consumption before and after τ to the utility values of wealth while in bondage (λ) and after the release from bondage (μ), respectively. Eq. (6) states that, at the optimal value of τ , the utility cost of remaining bonded for an extra instant, $[u(c_\tau^*) - u(c_\tau^b)]e^{-\delta\tau}$, must be equal to the benefit, $\lambda(w^b - c_\tau^b)e^{-r\tau} - \mu(w^* - c_\tau^*)e^{-r^*\tau}$, which is the utility value of the net wealth accumulated by staying in bondage an instant longer.

Let us assume the utility function takes the following CRRA form $u(c_t^b) = \frac{(c_t^b)^{1-\theta}}{1-\theta}$, $u(c_t^*) = \frac{(c_t^*)^{1-\theta}}{1-\theta}$, where $1/\theta$ is the elasticity of intertemporal consumption substitution. Then from eq. (4), the consumption path during the period of indebtedness is given by

$$c_t^b = c_0^b e^{\frac{r-\delta}{\theta}t}, \quad c_0^b = \lambda^{-1/\theta}. \quad (7)$$

so that the migrant's consumption rate while in bondage grows at a proportional rate equal to the product of $1/\theta$, and the difference between the rate of interest and the rate of time preference. By combining eqs. (7) and (2), we obtain

$$\frac{w^b}{r}(1 - e^{-r\tau}) - \frac{c_0^b}{g}(e^{g\tau} - 1) - D = 0, \quad (8)$$

where $g \equiv \frac{r-\delta}{\theta} - r$ is the proportional growth rate of the discounted (time 0) value of the consumption rate c_t^b .

If we assume for simplicity that δ equals the risk-free interest rate r^* , then the budget constraint (3) and the optimality condition (5) imply that the migrant's consumption after repayment of the debt is constant (c^*) and equal to his income, w^* . With $c^* = w^*$ and using $\lambda = c_0^{-\theta}$ from (7), condition (6) simplifies to

$$G = [u(w^*) - u(c_\tau^b)]e^{-r^*\tau} - (c_0^b)^{-\theta}(w^b - c_\tau^b)e^{-r\tau} = 0, \quad (9)$$

where G represents the net gain (in terms of discounted utility) from coming out of bondage an instant sooner. Noting that $c_\tau^b = c_0^b e^{\frac{r-\delta}{\theta}\tau}$, eqs. (8) - (9) can be solved for

the optimal length of the repayment period, τ , and the initial consumption rate, c_0^b , as functions of the exogenous variables.

3 Analysis of the Migrant's Behavior

The effects of the key exogenous variables, such as w^* , w^b , D , and r , on the migrant's optimal consumption profile and the duration of repayment period are summarized in the following propositions (see Appendix for derivation).

Proposition 1. *The migrant's optimal consumption profile, while in bondage, shifts a) down with an increase in w^* ; b) down with an increase in D ; c) down with an increase in r ; d) up with an increase in w^b .*

Proposition 2. *The optimal length of the repayment period a) decreases with an increase in w^* ; b) increases with an increase in D ; c) responds ambiguously to an increase in r ; d) responds ambiguously to an increase in w^b .*

The intuition behind these results is provided below.

3.1 Higher free-market wage

An increase in w^* makes the post-bondage period more attractive, which encourages the migrant to repay the debt and get out of bondage sooner. This requires a greater effort to save while indebted, implying that c_t^b is lower at each point in time prior to release. The jump in the consumption rate at time τ from $c_{\tau-}^b$ to $c_{\tau+}^*$ ($= w^*$) is therefore larger for a higher w^* .

In figure 1 we show the path of consumption while in bondage for various values of w^* . For the purpose of this illustration, we normalize the bonded wage w^b to 1 per week,

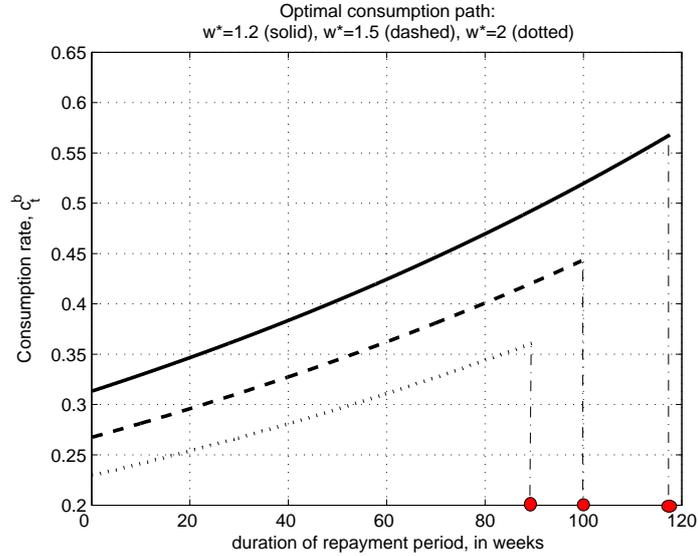


Figure 1: Optimal consumption rate and the length of debt-repayment period.

set $r^* = \delta = 5\%$ per year, and $\theta = 0.95$. The stock of debt is equal to 50 times the weekly bonded wage ($D/w^b = 50$) and $r = 30\%$ per year.⁶ The path of c_t^b is shown by the solid line for $w^* = 1.2$, dashed line for $w^* = 1.5$ and dotted line for $w^* = 2$. The simulations confirm that the time path of c_t^b shifts down and the duration of the debt repayment period falls as w^* rises. This result is somewhat counterintuitive in the sense that an increase in expected future income (w^*) results in a *drop* in consumption while in bondage, rather than intertemporal consumption smoothing. Consumption smoothing is precluded by the lack of access to credit at the risk-free rate r^* . The only way to take greater advantage of the increase in w^* is by trying to extend the period over which w^* is earned. That requires more rapid repayment of the loan, which in turn calls for a

⁶The 30% interest charge on the debt is reported by Kwong (1997, p.38) and Gao (2004, p.11). For indebted Thai sex workers in Japan, $D/w^b = 50$ is a realistic value (see Sobieszcyk (2000) and Human Rights Watch (2000)), while for indebted Chinese migrants in Western Europe and North America, a value of D/w^b in the range between 100 and 200 is suggested by Cattelain *et al* (2002), Gao and Poisson (2005), and Kwong (1997). The limited evidence on wages suggests that w^*/w^b can be in the range between 1 and 2, with the magnitude depending on the migrant's occupation and the host country in question (see Sobieszcyk (2000) and Human Rights Watch (2000)).

cut, rather than an increase, in consumption. Note that both the consumption path and τ would fall even more in response to any given increase in w^* if we were to choose a higher value of the elasticity of intertemporal consumption substitution.

3.2 Higher bonded wage

The effect of an increase in the bonded-labor wage, w^b , on the optimal length of the repayment period is ambiguous, reflecting the conflicting forces of the income and substitution effects. On the one hand, an increase in w^b works directly to relax the migrant's budget constraint, making it possible to pay off the debt more quickly for any given time path of consumption. On the other hand, a higher w^b also calls for an upward shift of the time path of c_t^b . The optimal increase in consumption is directly related to the magnitude of $1/\theta$.⁷ Thus the greater the elasticity of intertemporal consumption substitution, the larger the increase in c_0^b and the implied negative impact on the migrant's budget. If the absolute value of this impact is larger (smaller) than the direct positive budgetary effect of an increase in w^b , $d\tau/dw > 0$ (< 0).

3.3 Higher stock of debt

Figure 2 illustrates the relationship between the time path of consumption and the magnitude of indebtedness (measured in terms of the weekly bonded wage) for $D = 50$ (solid line), $D = 75$ (dashed line), and $D = 100$ (dotted line). An increase in D tightens the migrant's budget constraint, causing the time profile of consumption to shift down, while also lengthening the repayment period. It is interesting to note that, although c_0^b declines in response to an increase in D , the downward shift of the consumption path leaves the consumption rate just before the release from bondage, $c_{\tau-}^b$, unaffected.⁸ $c_{\tau-}^b$

⁷For the choice of τ to be optimal, eq.(9) must be satisfied. At a given τ , (9) implies that an increase in w^b (which reduces the gain from getting out of bondage an instant sooner) must be accompanied by an increase in c_0^b to reduce $u'(c_0^b)$ and hence the utility value of savings generated in bondage. This serves to raise G back to zero, satisfying (9). The required increase in c_0^b is directly related to the magnitude of $1/\theta$.

⁸It can be shown analytically that $dc_{\tau-}^b/dD = 0$. Our simulations confirm (see figure 2) that $c_{\tau-}^b = 0.44$ regardless of whether $D = 50, 75$ or 100 .

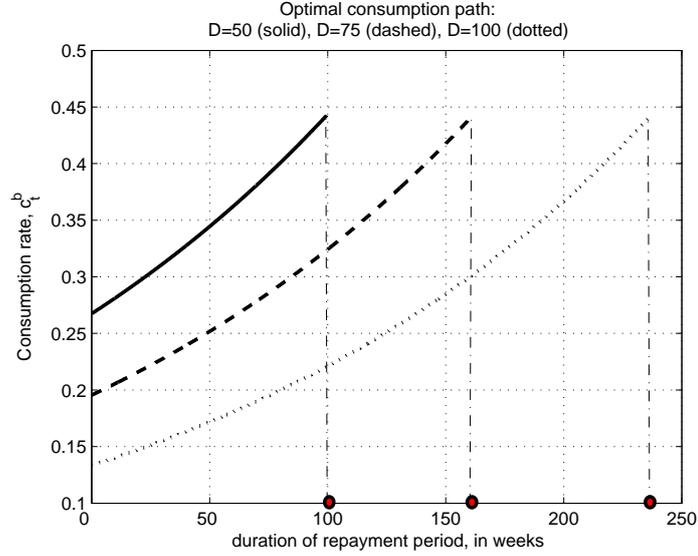


Figure 2: Consumption path for various values of D with $\delta = .05$, $\theta = .95$, $r = .3$, $w^* = 2$.

depends only on the relationship between the wages and the interest rates before and after release from bondage and the parameters of the utility function, but not on the value of D .

3.4 Higher rate of interest charged by the smuggler

The relationship between r and τ may be either positive or U-shaped, depending on the parameters of the model. This is illustrated in figure 3, which plots the optimal repayment period as a function of r for $D = 50$, when $w^* = 1.1$ (thin solid line), $w^* = 1.2$ (solid), $w^* = 1.5$ (dashed) and $w^* = 2$ (dotted).

An increase in r , on the one hand, encourages the migrant to repay the debt more quickly, contributing to a negative relationship between τ and r . At the same time it also lowers the present value of savings generated during the period of bondage, requiring a greater sacrifice of consumption, which the migrant will tend to spread over a longer repayment period. When the optimal saving rate is relatively high, either because of a large r or a large gap between w^* and w^b , the latter effect dominates so that $d\tau/dr > 0$.

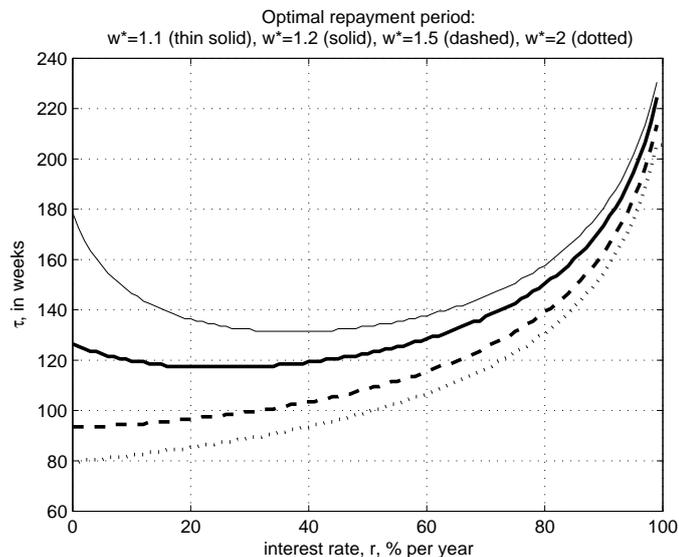


Figure 3: Optimal repayment period as a function of r for $\delta = .05$, $\theta = .95$, $D = 50$.

Alternatively, when the optimal saving rate of a bonded laborer is low, due to a low r and a small gap between w^* and w^b , τ decreases with an increase in r . This is the case for $w^* = 1.1$ and $w^* = 1.2$ in figure 3, where the relationship between τ and r is negatively sloped for low values of r .

4 Possibility of Deportation

Our analysis so far has been conducted on the assumption that the risk of deportation is nil, both in bondage and after the loan is paid off. This is probably the most appropriate assumption in the case of Chinese and other long-haul, bonded immigrants in the United States. In other countries, such as Italy, Spain, Greece, and Portugal, the numerous amnesty programs have also made it possible for illegal immigrants, including former bonded laborers, to obtain work permits on the basis of legitimate employment and eventually become permanent residents, citizens and in some cases very successful

entrepreneurs.⁹ The risk of deportation in these cases is small. In other contexts, however, it can be very significant. In an extensive study of Thai workers in Japan, Human Rights Watch (2000) reports numerous cases of debt-bonded migrants being arrested and deported, in some instances while still in bondage and in others after having completed loan repayment. As the prospect of deportation in such cases is a major factor, it is appropriate to ask how it affects a bonded migrant's optimal behavior in the context of our model.

4.1 Exogenous Expected Duration of Stay Abroad

For given enforcement measures and controls in the host country, let us assume in what follows that a bonded laborer can expect to remain at destination for only ϕ units of time. If it takes τ units of time to pay off the loan, this leaves a period of the length $\phi - \tau$ for employment in the host country at the free-market wage w^* . Thus the problem for a bonded laborer who migrates at age 0 is to

$$\max_{\tau, c_t^b, c_t^*, c_t} V = \int_0^\tau u(c_t^b) e^{-\delta t} dt + \int_\tau^\phi u(c_t^*) e^{-\delta t} dt + \int_\phi^T u(c_t) e^{-\delta t} dt$$

subject to the following budget constraints

$$\int_0^\tau (w^b - c_t^b) e^{-rt} dt = D, \quad (10)$$

$$\int_\tau^\phi (w^* - c_t^*) e^{-r^*t} dt + \int_\phi^T (w - c_t) e^{-r^*t} dt = 0, \quad (11)$$

where c_t and w are, respectively, the consumption rate and the (constant) real wage enjoyed by a deported migrant in the country of origin. The Lagrangian function is given by

$$\begin{aligned} L = & \int_0^\tau u(c_t^b) e^{-\delta t} dt + \int_\tau^\phi u(c_t^*) e^{-\delta t} dt + \int_\phi^T u(c_t) e^{-\delta t} dt \\ & + \lambda \left[\int_0^\tau (w^b - c_t^b) e^{-rt} dt - D \right] + \mu \left[\int_\tau^\phi (w^* - c_t^*) e^{-r^*t} dt + \int_\phi^T (w - c_t) e^{-r^*t} dt \right] \end{aligned}$$

⁹According to Gao (2004), many undocumented Chinese moved to Italy in 1990 from other Western European countries (Holland and France, in particular) to benefit from an amnesty for illegal aliens, including those classified as self-employed.

and the first-order conditions with respect to the choice variables are:

$$\frac{\partial L}{\partial c_t^b} = u'(c_t^b)e^{-\delta t} - \lambda e^{-rt} = 0, \quad (12)$$

$$\frac{\partial L}{\partial c_t^*} = u'(c_t^*)e^{-\delta t} - \mu e^{-r^*t} = 0, \quad (13)$$

$$\frac{\partial L}{\partial c_t} = u'(c_t)e^{-\delta t} - \mu e^{-r^*t} = 0, \quad (14)$$

$$\frac{\partial L}{\partial \tau} = [u(c_\tau^b) - u(c_\tau^*)]e^{-\delta\tau} + \lambda(w^b - c_\tau^b)e^{-r\tau} - \mu(w^* - c_\tau^*)e^{-r^*\tau} = 0. \quad (15)$$

Assuming that $\delta = r^*$, it follows from (13) and (14) that $u'(c_t^*) = u'(c_t) = \mu$. With the utility function $u(c) = \frac{c^{1-\theta}}{1-\theta}$, this implies $c_t^* = c_t \equiv c = \mu^{-1/\theta}$. Along with the budget constraint (11), we obtain

$$c = \frac{w^*(e^{-r^*\tau} - e^{-r^*\phi}) + w(e^{-r^*\phi} - e^{-r^*T})}{e^{-r^*\tau} - e^{-r^*T}}. \quad (16)$$

From (12) and the budget constraint (10),

$$c_t^b = c_0^b e^{\frac{r-r^*}{\theta}t}, \quad c_0^b = \left[w^b \frac{1 - e^{-r\tau}}{r} - D \right] \frac{g}{e^{g\tau} - 1},$$

where $g \equiv \frac{r-r^*}{\theta} - r$.

Figure 4 illustrates the migrant's optimal consumption paths for two alternative values of ϕ , assuming in each case that his expectations with respect to the date of deportation are fulfilled. The solid line corresponds to $\phi = 5$ years and the dashed line is drawn for $\phi = 3$ years, on the assumption that $w^* = 2$, $w^b = 1$, $w = 0.2$, $D = 50$, and $r = 0.6$. A shortening of the expected duration of stay abroad reduces the discounted value of lifetime earnings, generating a negative wealth effect. This is shown to shift the consumption path down and accelerate debt repayment. Once the debt is paid off, consumption jumps to a higher, constant rate, with the jump being larger the longer the expected duration of stay in the host country.¹⁰

¹⁰Explicit treatment of uncertainty would make our model more complex. Suppose that the event of deportation follows a stochastic process, say, a Poisson process with the mean arrival rate λ . In that setting, ϕ can be interpreted as the average waiting time until the first arrival, so that $\phi = 1/\lambda$. In relation to the

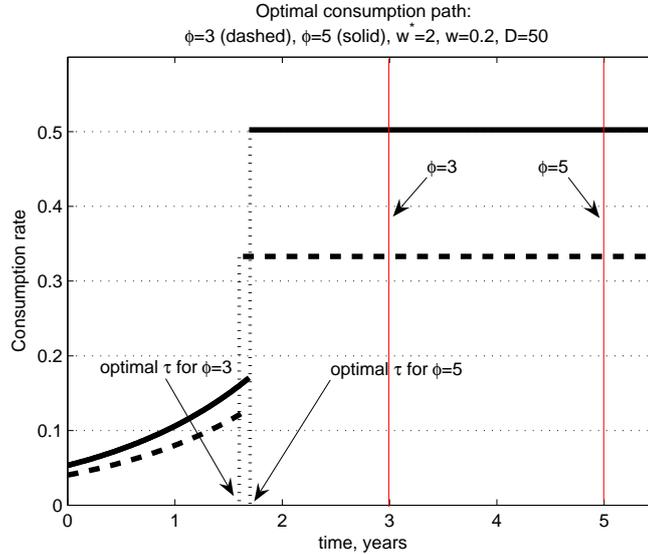


Figure 4: Optimal consumption path: $\phi = 3$ (dashed), $\phi = 5$ (solid).

4.2 No Deportation while in Bondage

In their work on debt-financed migration, Friebel and Guriev (2006) assume that the human smuggling organization, to which the migrant is indebted, is able to conceal the migrant with a partner enterprise and thereby avoid deportation. Detection and deportation, in their model, can occur only after exiting bondage.¹¹ Under this assumption, the problem facing an indebted migrant is somewhat different: Being in bondage, rather than free, guarantees protection from deportation, which is a valuable service from the perspective of the migrant. Should the bonded wage be greater than the weighted average of the free-market wage abroad and at home (with the weights being

preceding discussion, the effect of uncertainty on the key endogenous variables could be readily predicted. First of all, the time-path of consumption of the debt-bonded migrant tilts counter-clockwise with the initial consumption rate being lower than c_0^b . Lower initial consumption contributes to a more rapid repayment of the debt, at least in the initial stages. The pace of repayment subsequently slows down and the consumption rate increases (relative to its value in the deterministic case) for as long as the migrant avoids deportation. A dynamic stochastic optimization model of saving behavior of a *debt-free* illegal immigrant, who is subject to deportation, is analyzed by Vinogradova (2010).

¹¹In the case of Thai sex workers in Japan, there is considerable evidence that this is often the case (see Human Rights Watch (2000)).

$(e^{-r^*\phi} - e^{-r^*\tau})/(e^{-r^*T} - e^{-r^*\tau})$ and $(e^{-r^*T} - e^{-r^*\phi})/(e^{-r^*T} - e^{-r^*\tau})$, respectively), it pays for the migrant to continue working at the bonded wage for the partner of the smuggling organization even after the loan is paid off. The protection from deportation that this arrangement offers is more valuable in that case than the option of being free to work at the wage w^* .

A migrant will give up the protection only if the risk of deportation is low (i.e., large expected value of ϕ) and/or the cost of protection provided by the underground-economy employer is high (i.e., a large gap between w^* and w^b) and/or the expected loss of income due to deportation is small (i.e., a relatively small gap between w^* and w). Not surprisingly, it is sometimes observed in Chinese communities in Western Europe, that former bonded laborers continue to work in the underground economy at what are practically bonded wages, simply because that employment arrangement significantly reduces the risk of deportation.¹² In general, for a given host country, we should expect that bonded migrants who come from very poor countries of origin are *less* likely to surface from the underground economy after having been released from debt bondage. Prospect of deportation signifies for them a potentially large loss of income. By contrast, those who originate from countries with relatively higher wages stand to suffer a smaller loss of income if deported and, therefore, are more likely to give up the protection provided by their clandestine employers.

Our model also has important implications concerning the attitude of illegal immigrants with respect to legalization of their residence status in the host country. It is widely recognized that the highest priority for Chinese debt-bonded migrants in Western Europe, after having repaid their debts, is to legalize their residence status (see Gao (2004, p.7) and Gao and Poisson (2005, p.70)). No effort is spared and nothing is more important than getting a "residence permit". From the perspective of our model, for those who face substantial risk of deportation, this behavior is dictated by two large wage

¹²See Gao and Poisson (2005).

gaps: That between w^* and w , which makes protection from deportation very valuable, and that between w^* and w^b , which makes protection provided by the underground-economy employer very costly, inducing an undocumented alien to seek, instead, the protection of a residence permit. In other regimes, where the risk of deportation is very low and the two aforementioned gaps relatively small, as in the case of undocumented Mexicans working in the U.S.A., the quest for legal status is a much lower priority for undocumented aliens.

5 The Role of Policy Instruments

The preceding analysis of the migrant's optimal behavior provides a framework for an evaluation of how various immigration policy measures affect the welfare of a debt-bonded laborer. This offers insights on the potential role of host-country policies in addressing the problem of debt-bonded migration (hereafter DBM) by deterring this form of international labor mobility.

If the alternative for a source-country worker is not to migrate, the lifetime utility of staying at home is simply

$$V^N = \int_0^T \frac{w^{1-\theta}}{1-\theta} e^{-\delta t} dt = \frac{w^{1-\theta}}{1-\theta} \left[\frac{1 - e^{-\delta T}}{\delta} \right]. \quad (17)$$

To illustrate the role of border controls and deportation measures in influencing migration decisions, we now calculate combinations of migration costs, D , and the expected duration of stay abroad until deportation, ϕ , such that a worker is indifferent between staying permanently at home and migrating to the host country as a bonded laborer (see figure 5). For the purpose of this calculation we set the parameters as follows: $\delta = 0.05$, $r = 0.3$, $\theta = 0.95$, and the weekly wages are $w^* = 2$, $w^b = 1$, and $w = 0.2$.¹³ In the ab-

¹³Although the descriptive literature based on interviews with Chinese immigrants in Western Europe and North America offers a wide range of values for w^b , w , and w^* , it is realistic to assume that the free-market real wage in the host country is 10 times greater than that of the source country, while the bonded wage is roughly one half of the free market wage.

sence of deportation measures, such that undocumented immigrants can stay in the host country as long as they like (i.e. $\phi = T$), deterring DBM requires that border controls be effective enough to make the cost of migration $D \geq \bar{D} = 168.31$. This amounts to 1.62 years of earnings in the host country at the free-market wage of $w^* = 2$ per week. If

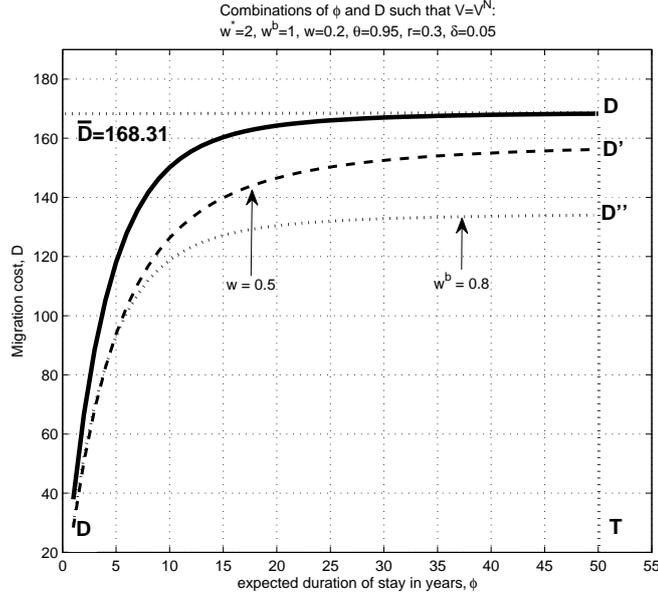


Figure 5: Combinations of migration costs and ϕ such that $V = V^N$.

apprehension and deportation measures are applied such that a migrant cannot expect to remain in the host country for the entire planning horizon, but rather for a period of time measured along the horizontal axis in figure 5, then DBM is deterred for those combinations of D and ϕ that lie above the DD schedule. For combinations below it, it pays to migrate as a debt-bonded laborer.

The position of the DD locus depends, of course, on the parameters of the model. The dashed DD' schedule shows the effects of an increase in the wage of the source country from $w = 0.2$ to $w = 0.5$, while the remaining parameters are held at their benchmark levels. A higher w makes it more attractive for potential migrants to remain at home, shifting DD down and to the right. Thus for any given ϕ , less restrictive border control

measures are sufficient to deter DBM from source countries with relatively higher wages.

Tougher enforcement of labor laws in the host country and more severe employer sanctions that make it riskier for employers to hire indebted, undocumented migrants, tend to reduce w^b for any given w^* . This also shifts DD down and to the right. The dotted DD" schedule in figure 5 corresponds to a lower bonded wage of $w^b = 0.8$ rather than $w^b = 1$, with other parameters at the benchmark levels.

It is also interesting to compare the relative effectiveness of the three immigration-policy tools (i.e., border controls, deportation measures, and employer sanctions) and illustrate how they interact in deterring DBM. Our simulation results for parameter values in the neighborhood of the benchmark case show that, when deportation measures are already strict, a further policy tightening (i.e., a further reduction in ϕ) has a more powerful effect in deterring debt-bonded migration than if the tightening occurs from a relatively high value of ϕ . Suppose, for instance, that ϕ is reduced by 10% from 1 to 0.9 years. Then the cost of migration that keeps a potential migrant just indifferent between DBM or remaining at home falls by 8.8% from 37.95 to 34.61. On the other hand, if ϕ is reduced by 10% from 10 to 9 years, D falls by only 2.5% from 150.15 to 146.40. These findings illustrate two important points: (a) Host countries with stricter deportation policies can deter DBM with much less intensive border controls and (b) moving to stricter deportation policies is considerably more effective when the migrant's expected duration of stay in the host country is already low.

Tougher labor-law enforcement and employer sanctions (to the extent they reduce w^b), can also substitute for border control measures. For instance, a 20% decline in w^b from 1 to 0.8, with $\phi = 1$ year, calls for a reduction in D of approximately 21% to keep a potential migrant indifferent between DBM and not migrating. It is interesting to note that this magnitude of the percentage change in D is almost completely insensitive with respect to the value at which ϕ is held constant. Higher intensity of labor-law enforcement can therefore substitute for vigorous border control measures, to the point

of allowing the cost of migration to decline in roughly the same proportion as the decline in w^b , regardless of whether strict or lax deportation policies are in place.

Finally, tightening of border controls is found to be more effective as a deterrent in the presence of tough labor-law enforcement and employer sanctions that lower w^b relative to w^* . This is because the lower the bonded wage, the more difficult it is to repay migration debts. The duration of the indebtedness phase is then longer and, for a given ϕ , the expected duration of the period over which the migrant can earn w^* correspondingly shorter. This finding is reflected in the fact that the slope of the DD" schedule in figure 5 is lower, for any given ϕ , than that of the DD schedule.

The interaction among the various immigration policy instruments in helping to deter DBM is illustrated more compactly in figure 6. The calculations are performed for the benchmark values of the parameters (displayed on top of the figure) to generate a three-dimensional surface along which a potential migrant is indifferent between remaining at home and DBM. Migration costs are measured along the vertical axes, while the migrant's expected duration of stay until deportation, ϕ , and the bonded wage, w^b , are measured along the two horizontal axes. For any combinations of policies that generate values of D , ϕ , and w^b above (below) the surface, it does not (does) pay to migrate.

The main message conveyed by figures 5 and 6 is that a stricter deportation policy is a very potent substitute for border controls and employer sanctions when the expected duration of a migrant's undocumented stay in the host country is already low. For low values of ϕ , the utility of DBM is extremely sensitive to the expected duration of stay, while variations in migration costs and the bonded wage play a less significant role.

The implicit trade-off among immigration policy instruments illustrated in figure 6 is a potentially valuable policy tool. In conjunction with information on the required expenditures on enforcement in order to attain any given combination of D , ϕ , and w^b , it makes it possible for policymakers to determine the most cost-effective way of deterring DBM. Cost effectiveness, however, is only one element. Other factors, such as political

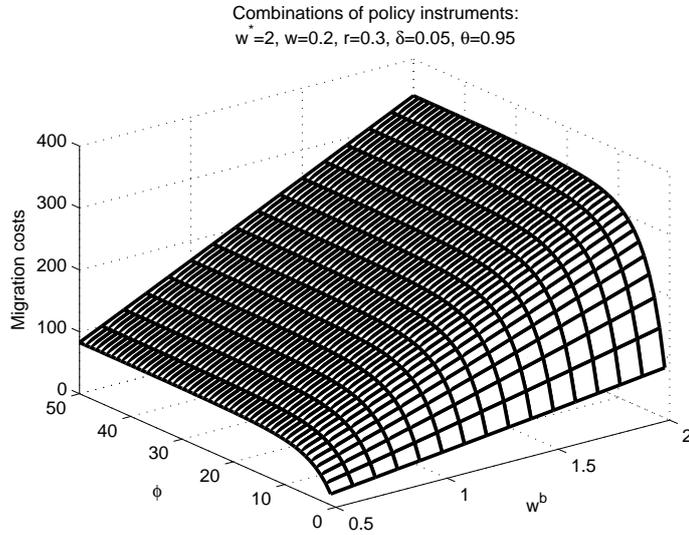


Figure 6: Combinations of migration costs, bonded wage, and ϕ such that $V = V^N$.

feasibility and humanitarian considerations, may impose limitations on the degree to which any one of the instruments may be utilized.

6 Concluding Remarks

In spite of its apparently growing importance, very little is known about illegal immigration in the form of debt-bonded labor. Only a few descriptive studies are available along with pieces of evidence based on a relatively small number of interviews. What these studies suggest, nonetheless, is that the very large gaps in wages between the rich and poor countries along with the high cost of illegal immigration are making debt-bonded migration (DBM) an attractive and sometimes the only migration option available to millions of willing migrants in the developing world.

To better understand this particularly controversial form of international labor mobility and the role of immigration policies in helping to deter it, it is important to start with the analysis of optimizing behavior of a migrant. The implications of policies aimed

at reducing DBM cannot be examined without first thinking through the problem from the perspective of a migrating individual. The present paper takes a step in this direction with a focus on his consumption-saving profile and the optimal duration of the debt repayment period. Our model is designed to address the problem in a very simple setting where the risk of deportation is initially nil and the migrant is a single individual with no intention of returning to the source country. It is found that stricter employer sanctions, to the extent that they lower the bonded wage, decrease the migrant's consumption while in debt, leave it unaffected after debt repayment, and have an ambiguous effect on the optimal duration of the repayment period. By contrast, an increase in the free-market wage *lowers* consumption while in debt, raises it after the loan is repaid, and shortens the duration of the repayment period. An increase in the interest rate charged by the smuggler lowers consumption while in debt, leaves it unchanged after debt repayment and may either reduce or extend the repayment period, depending mainly on the size of the debt, the relationship between the bonded and free-market wage and the level of the interest rate.

We subsequently introduce the prospect of deportation in our model. If the expected duration of stay in the host country is reduced due to more vigorous detection, apprehension, and deportation measures, loan repayment is accelerated. To the extent that the smuggling organization is able to shield a migrant from deportation while he is repaying the debt, this tends to lengthen the repayment period. In our evaluation of the trade-off among immigration policy instruments aimed at deterring debt-bonded migration, we find that tougher deportation policies are very effective in substituting for border controls and employer sanctions when the expected duration of an undocumented stay in the host country is already low. Tightening of border controls is found to be more effective as a deterrent in the presence of tough labor-law enforcement and employer sanctions that keep the bonded wage low relative to the free-market wage. Finally, tighter border controls and labor-law enforcement measures are found to have similar degrees of

effectiveness for any given deportation policy.

At the empirical level, debt-bonded migration is clearly the most under-researched area of study in the domain of international migration. While it would be interesting to test our model by confronting it with the evidence, there is very little data available on wages earned by modern-day bonded laborers, their migration costs, and the length of the repayment period. Data on interest rates and consumption patterns of indebted migrants is also very limited, with researchers often focusing on cases of migrants being abused by the trafficking organizations. Broader and more structured empirical investigations of debt-bonded migration would be very useful in helping researchers and policymakers understand this increasingly important phenomenon.

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Appendix

The system of equations (8) - (9) yields the following comparative statics results:

$$\frac{dc_0^b}{dw^*} = -\frac{u'(w^*)e^{-\delta\tau}(w - c_\tau^b)e^{-r\tau}}{\Delta} < 0$$

$$\frac{dc_0^b}{dw} = \frac{(c_0^b)^{-\theta}(w - c_\tau^b)e^{-r\tau}}{\Delta} \left[\frac{1 - e^{-r\tau}}{r}(r - \delta) + e^{-r\tau} \right] > 0$$

$$\frac{dc_0^b}{dD} = -\frac{(c_0^b)^{-\theta}(w - c_\tau^b)e^{-r\tau}}{\Delta}(r - \delta) < 0$$

$$\frac{dc_0^b}{dr} = \frac{(c_0^b)^{-\theta}(w - c_\tau^b)e^{-r\tau}}{\Delta} \left[B_r(r - \delta) - \tau(we^{-r\tau} - c_0^b e^{g\tau}) \right] < 0,$$

$$\frac{d\tau}{dw^*} = -\frac{1}{\Delta} \left[\frac{e^{g\tau} - 1}{g} u'(w^*)e^{-\delta\tau} \right] < 0$$

$$\frac{d\tau}{dw} = \frac{1}{\Delta} \left[\frac{e^{g\tau} - 1}{g} - \frac{\theta}{c_0^b}(w - c_\tau^b) \frac{1 - e^{-r\tau}}{r} \right] (c_0^b)^{-\theta} e^{-r\tau} \geq 0$$

$$\frac{d\tau}{dD} = \frac{(c_0^b)^{-\theta}(w - c_\tau^b)e^{-r\tau}}{\Delta} \frac{\theta}{c_0^b} > 0$$

$$\frac{d\tau}{dr} = \frac{(c_0^b)^{-\theta}(w - c_\tau^b)e^{-r\tau}}{\Delta} \frac{\theta}{c_0^b} \left[-\frac{\tau c_0^b e^{g\tau} - 1}{\theta g} - B_r \right] \geq 0,$$

where $B_r = \frac{w}{r}(\tau e^{-r\tau} - \frac{1 - e^{-r\tau}}{r}) - \frac{c_0^b}{g} \frac{1 - \theta}{\theta} (\tau e^{g\tau} - \frac{e^{g\tau} - 1}{g}) < 0$ and $\Delta = (c_0^b)^{-\theta}(w - c_\tau^b)e^{-r\tau} \left[\frac{e^{g\tau} - 1}{g}(r - \delta) + (we^{-r\tau} - c_0^b e^{g\tau}) \frac{\theta}{c_0^b} \right] > 0$.