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Financial Support from the Family Network and Illegal Immigration

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Abstract

Barriers to immigration of low-skilled workers from developing countries into the advanced countries prevent many potential migrants from leaving their countries of origin. With very low home-country wages in relation to the cost of undocumented migration, the opportunity to migrate often hinges on becoming indebted to a human smuggling organization or family and friends. This paper examines the conditions under which migration is optimal for an individual who lacks liquid assets, with a focus on alternative options for financing migration costs. One is by accumulating the required amount of savings out of source-country income, with or without financial support from the family or social network. The other is debt-bonded migration, which involves borrowing from a smuggling organization and paying off the loan while working in the host country. I find that greater financial support from the family network increases the attractiveness of debt-bonded relative to self-financed migration.

JEL Classification: F22, J61

Key Words: liquidity constraints, debt-bonded labor, illegal immigration, financial support.

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1 Introduction

Ethnic networks, community ties and family connections across international borders play a very important role in facilitating migration. They link the social structure to the individual decision maker to provide potential migrants with information and other forms of assistance that reduce the costs and raise the benefits of going abroad.[1] With the sharp increase in the cost of undocumented migration over the last couple of decades, networks are also playing an increasingly important role in helping migrants to finance their journey to the host country. For low-skilled workers from the developing world, facing human-smuggling fees as high as $50,000 on long-haul routes, the cost of a journey can be practically insurmountable if it has to be paid out of one's own savings.

The focus of the present study is on the problem of meeting the cost of migration. There are fundamentally two alternative modes of funding available. One possibility is to accumulate savings out of income earned in the source country and, if possible, supplement these savings by borrowing from family members and friends, some of whom may already be located abroad. When borrowing from a family network, the contract is typically informal, with the interest burden (if any) relatively light. Alternatively, a potential migrant may choose to enter into a much more constraining debt-bondage contract with a smuggling organization. The principal advantage of doing so is that the arrangement allows the migrant to reach the destination country without a substantial delay. This makes it possible to start working at a higher wage earlier within the planning

[1] See, e.g., Massey (1987) Boyd (1989), Massey et al (1993, 1994), Portes (1995), Munshi (2003) Beine, Docquier, and Özden (2011), and McKenzie and Rapoport (2010)

horizon. The main disadvantages of debt bondage, however, is the heavy interest burden that the migrant has to carry over the indebtedness period (i.e., 20%-60% per year).[2] As for other disadvantages, a debt-bonded migrant's freedom of movement is restricted, there is no possibility of changing employers during the debt-repayment phase, and the compensation for labor services used in the calculation of loan repayment is typically below the prevailing wage in the underground economy of the host country.[3]

This paper investigates the problem facing a liquidity-constrained candidate for migration within a framework of analysis developed by Djajić and Vinogradova (2014). The new element here is the focus on the role of financial support from the family network in determining whether a migrant chooses to self finance migration by saving the additional funds needed to pay for the journey or chooses debt bondage as the optimal financing option. As in the earlier studies on debt-bonded migration (Friebel and Guriev, 2006 and Djajić and Vinogradova, 2013, 2014), the scope of the present paper is limited to *voluntary* debt-bondage contracts. The problem of human trafficking, which involves deception, strategic behavior, coercion, kidnapping, and even violence, is not addressed in this paper.[4] My objective is simply to determine how a worker's optimal migration strategy is related to the degree of financial support available from the family network as

[2]See Kwong (1997, p.38), Gao (2004, p.11) and Sobieszczyk (2000, p.412). In the case of Chinese migrants to the West, an interest rate of 2% per month is most common according to Kwong.

[3]An example of a debt bondage situation is when a person commits to repay a debt of say $5000 for recruitment fees and travel costs by agreeing "...to sew clothes until this 'debt' is repaid. The market wage for the work is $50 per day but the employer/enforcer only deducts $20 a day from the debt..." (Jordan, 2011). Gao and Poisson (2005), Human Rights Watch (2000), Kwong (1997), Salt (2000), Sobieszczyk (2000), Stein (2003), Surtees (2003), United States Department of State (2006), and Vayrynen (2003) provide informative discussions of the conditions facing migrants in debt bondage.

[4]For an analysis of the problem facing migrants in a trafficking situation, see Tamura (2010, 2013). Mahmoud and Trebesch (2010) examine the factors that influence the incidence of trafficking within a migrant population. None of these studies, however, focus on the question of how migration is financed.

he tries to meet the cost of migration. The main finding of the paper is that an increase in this type of support helps not only to facilitate migration, as one would expect, but it also makes the debt-bondage option relatively more attractive when compared with self finance.

The remainder of the paper has the following structure. Section 2 describes the migrant's optimization problem in the debt-bondage and self-finance scenarios. Section 3 compares the utility of remaining permanently at home with the utilities of migrating under these two alternative financing schemes. This allows for a characterization of the environment in which each one of the three options is the most attractive. Section 4 examines the role of financial support from the family network in influencing migration decisions. Finally, Section 5 concludes the paper by summarizing its main results and offering suggestions for further research.

2 Self-Financed vs Debt-Bonded Migration

There are essentially two different ways of meeting migration costs: By accumulating savings out of source-country income (self-financed migration) and by borrowing from a smuggler with a commitment to repay the loan out of income earned in the destination country (debt-bonded migration). Regardless of the financing mode, let us assume that the smuggling organization guarantees passage to the destination. This is the case, for example, in the Chinese market for human smuggling. If the first attempt fails, the contract requires the smuggling organization to try again. Full payment for the smuggling service is due only after the client arrives safely at the destination.

As noted in the Introduction, an advantage of self-financed (SF) in relation to debt-bonded (DB) migration is that the migrant does not have to pay excessive interest charges and is not subject to the constraints of bondage while repaying the loan to the smugglers in the host country. On the other hand, the advantage of DB over SF is that it allows the migrant to reach the host country sooner. This enables him to sell labor services at a wage higher than that of the source country, although the bonded wage is typically lower than the free-market wage at the destination.

2.1 SF Migration with Financial Support

Consider first the problem facing a migrant who accumulates savings out of home-country earnings to pay for migration costs, K, possibly with financial support from the family network. He maximizes utility of consumption over a planning horizon extending from time $t = 0$ to T. There is a single consumption good which serves as the numeraire. I assume that the fraction $\alpha \in [0, 1]$ of K can be covered by borrowing from the family network with a commitment to repay the loan (plus interest at the home-country rate ρ) out of earnings abroad. During the period $[0, \phi]$ an SF migrant earns the source-country wage, w, and consumes at the rate c_t, while saving $(1 - \alpha)K$ units of output in order to pay for the cost of migration at the optimally-chosen time of departure, ϕ. From time ϕ until T, he stays in the host country, earns $w^* > w$, consumes at the rate c_t^*, repays the debt to the family network, and is able to lend and borrow at the host-country interest rate r^*. His rate of time preference is denoted δ.

The problem for an SF migrant is to choose the consumption rates at home and

abroad, c_t and c_t^*, respectively, and the duration of the pre-departure, asset-accumulation period, ϕ, given δ, w^*, w, ρ, r^*, α, and K, all of which are assumed constant. Let us suppose that the migrant has no initial asset holdings and migration occurs instantaneously. The assumption on initial asset holdings is relaxed at the end of Section 4.

An SF migrant's objective function can be written as

$$\max_{c_t, c_t^*, \phi} \quad \int_0^{\phi} u(c_t) e^{-\delta t} dt + \int_{\phi}^{T} u(c_t^*) e^{-\delta t} dt. \tag{1}$$

In maximizing (1), he faces two budget constraints. First, over the pre-migration phase, his accumulated savings must sum up to the cost of migration that cannot be covered by a family loan:

$$\int_0^{\phi} (w - c_t) e^{\rho(\phi - t)} dt = (1 - \alpha) K. \tag{2}$$

Second, his net savings while abroad, discounted at the market rate of interest, r^*, must add up to the amount, αK, borrowed from the family network at time ϕ:

$$\int_{\phi}^{T} (w^* - c_t^*) e^{-r^*(t - \phi)} dt = \alpha K. \tag{3}$$

The Lagrangian function is given by

$$L = \int_0^{\phi} u(c_t) e^{-\delta t} dt + \int_{\phi}^{T} u(c_t^*) e^{-\delta t} dt + \lambda \Big[\int_0^{\phi} (w - c_t) e^{-\rho t} dt - (1 - \alpha) K e^{-\rho \phi} \Big] +$$

$$+ \mu e^{-\delta \phi} \Big[\int_{\phi}^{T} (w^* - c_t^*) e^{-r^*(t - \phi)} dt - \alpha K \Big]$$

where λ and μ are the multipliers attached to the constraints (2) and (3) respectively. Let us assume for simplicity that $\rho = \delta = r^*$. The first-order conditions can then be

written as:

$$\frac{\partial L}{\partial c_t} = u'(c_t) - \lambda = 0, \tag{4}$$

$$\frac{\partial L}{\partial c_t^*} = u'(c_t^*) - \mu = 0, \tag{5}$$

$$\frac{\partial L}{\partial \phi} = u(c_\phi) - u(c_\phi^*) + \lambda[w - c_\phi + \rho(1-\alpha)K] + \mu(c_\phi^* - w^*) = 0. \tag{6}$$

and the budget constraints (2) and (3). These five equations determine the five endogenous variables c_t, c_t^*, ϕ, λ, and μ. Eq. (4) implies that the consumption rate during the period of asset accumulation at home, $t \in [0, \phi_-]$, is constant. Along with the budget constraint (2) and assuming that the utility function takes the following CRRA form, $u(c_t) = c_t^{1-\theta}/(1-\theta)$, where $1/\theta$ is the elasticity of intertemporal consumption substitution (EICS), we have

$$c_t = c = w - \frac{\rho(1-\alpha)K}{e^{\rho\phi} - 1}, \quad \lambda = c^{-\theta}, \tag{7}$$

showing that the migrant must save in the source country just enough to pay for the fraction $(1-\alpha)$ of migration costs that cannot be covered by a family loan agreement. Eq. (5) implies that the migrant's time profile of consumption abroad is flat at the rate $c_t^* = c^* = \mu^{-1/\theta}$. Combining this with the budget constraint (3), we obtain:

$$\frac{w^* - c^*}{r^*}(1 - e^{r^*(\phi - T)}) = \alpha K, \tag{8}$$

which guarantees that the family loan in the amount αK is repaid with interest (at the rate $\rho = r^* = \delta$) out of income earned in the host country.

The optimality condition (6) with respect to the departure date, ϕ, can be rewritten as

$$u(c^*) - u(c) = c^{-\theta}[w - c + \rho(1-\alpha)K] - (c^*)^{-\theta}(w^* - c^*). \tag{9}$$

Thus at the optimal time of departure from the source country, the utility sacrificed by staying at home an instant longer, $u(c^*)-u(c)$, must be equal to the net benefit, which is the difference between the utility value of the savings accumulated over that unit of time at home, $c^{-\theta}[w-c+\rho(1-\alpha)K]$, and the utility value of the savings that could have been accumulated abroad, $(c^*)^{-\theta}(w^*-c^*)$, had the migrant moved an instant sooner. Note that on arrival in the host country, the migrant's consumption jumps instantaneously from c to c^*.

Eqs. (7), (8) and (9) can be solved for the three key endogenous variables, c, c^* and ϕ, as functions of the exogenous variables, including α, w, w^*, and K. The level of discounted lifetime utility enjoyed by a migrant under the self-finance arrangement with family support is given by

$$U^{SF} = \frac{1}{1-\theta}\Big[\frac{c^{1-\theta}}{\delta}(1-e^{-\delta\phi}) + \frac{(c^*)^{1-\theta}}{\delta}(e^{-\delta\phi}-e^{-\delta T})\Big], \tag{10}$$

where c, c^* and ϕ are optimally chosen.

2.2 Debt-Bonded Migration with Financial Support

Although debt-bonded migration is emerging as an increasingly important mode of international labor mobility, it is by no means a new phenomenon. In Colonial America of the 17th and 18th centuries, shortage of labor on the newly established tobacco plantations and grain farms in Chesapeake (Maryland and Virginia) and Pennsylvania brought about innovative financing schemes to help facilitate migration. For workers in Britain and continental Europe who wanted to work in the colonies but were unable to cover the cost of migration, which was roughly 6 months worth of wages for a British worker and

1 year's wages for a worker from Germany, there was the possibility to finance the cost of migration by becoming an indentured servant. This meant agreeing to pay the shipping company for the cost of the journey by being auctioned off to an employer within several days after arrival. With the employer thus becoming the creditor, a migrant's debt was typically repaid with 3-4 years of labor by an adult male. Over the period of indebtedness, indentured servants were not paid wages. They were provided, instead, with accommodation, food, clothing, and training by their employer, with the contracts well defined and enforced by the colonial governors (Galenson, 1984).

Similar type of an arrangement is used to bring migrants from Asia and Sub-Saharan Africa to the West over the last three decades. I consider here a somewhat richer contractual framework, developed by Djajić and Vinogradova (2013, 2014), which enables the migrant to optimally choose the duration of the repayment period. This type of arrangement is very common in case of debt-bonded migration from South-East Asia to the advanced countries of East Asia (see Jones and Pardthaisong, 1999, Sobieszczyk, 2000, and Djajić and Vinogradova, 2013).

Let us assume that the smuggling organization delivers the migrant to the destination country at time 0, where he stays until time T. The loan from the smugglers is in the amount $(1-\alpha)K$, which corresponds to the gap between the cost of migration and the amount of financial support that the migrant is able to obtain from his family network. The migrant commits to repay the debt to the smuggling organization by the time $\tau \in (0,T)$, with interest at the rate r, while working for it at the bonded wage, w^b. I assume that $r > r^*$ and $w < w^b < w^*$, which is consistent with the structure of

the environment facing modern-day, debt-bonded migrants. A candidate for migration is assumed to take r and w^b as given. Once the debt to the smugglers is repaid, the migrant is released from bondage and free to earn w^*, as well as to lend and borrow at the rate r^*. Over this phase of the planning horizon, he is also obliged to start (and finish) repaying the loan that was provided by the family network.

A debt-bonded migrant's objective is to maximize his discounted lifetime utility

$$\int_0^\tau u(c_t^b)e^{-\delta t}dt + \int_\tau^T u(c_t^{b*})e^{-\delta t}dt, \tag{11}$$

with respect to the duration of the debt-repayment period, τ, his consumption rates while indebted, c_t^b, and after being released from bondage, c_t^{b*}, subject to two budget constraints. First, during the bondage period, the present value of his savings, discounted at the smuggler's rate of interest, r, must be equal to the debt owed to the smuggler:

$$\int_0^\tau (w^b - c_t^b)e^{-rt}dt = (1-\alpha)K \tag{12}$$

Second, once this debt is repaid, the migrant's savings over the remainder of his planning horizon, discounted at the rate ρ, must cover the debt owed to the family network:

$$\int_\tau^T (w^* - c_t^{b*})e^{-r^*(t-\tau)}dt = \alpha K e^{\rho\tau}. \tag{13}$$

The Lagrangian function is given by

$$\begin{aligned} L^b &= \int_0^\tau u(c_t^b)e^{-\delta t}dt + \int_\tau^T u(c_t^{b*})e^{-\delta t}dt + \lambda^b\big[\int_0^\tau (w^b - c_t^b)e^{-rt}dt - (1-\alpha)K\big] + \\ &+ \mu^b e^{-\delta t}[\int_\tau^T (w^* - c_t^{b*})e^{-r^*(t-\tau)}dt - \alpha K e^{\rho\tau}]. \end{aligned}$$

Noting that $\rho = r^* = \delta < r$, the first-order conditions can be written as

$$\begin{aligned}
\frac{\partial L^b}{\partial c_t^b} &= u'(c_t^b)e^{-\delta t} - \lambda^b e^{-rt} = 0, && (14)\\
\frac{\partial L^b}{\partial c_t^{b*}} &= u'(c_t^{b*}) - \mu^b = 0, && (15)\\
\frac{\partial L^b}{\partial \tau} &= u(c_\tau^b)e^{-\delta\tau} - u(c_\tau^{b*})e^{-\delta\tau} + \lambda^b(w^b - c_\tau^b)e^{-r\tau} - \\
&\quad \mu^b e^{-\delta\tau}(w^* - c_\tau^{b*} - \rho\alpha K e^{\rho\tau}) = 0, && (16)
\end{aligned}$$

and the budget constraints (12) and (13). These five equations determine the five endogenous variables c_t^b, c_t^{b*}, τ, λ^b, and μ^b. On the basis of (14), we can express the migrant's optimal consumption path for $t \in [0, \tau_-]$ as

$$c_t^b = c_0^b e^{\frac{r-\delta}{\theta}t}, \tag{17}$$

which shows that his consumption rate while in bondage grows at a proportional rate equal to the product of the EICS and the difference between the rate of interest charged by the smuggler and the migrant's rate of time preference. Combining (17) with (12) we obtain

$$\frac{w^b}{r}(1 - e^{-r\tau}) - \frac{c_0^b}{g}(e^{g\tau} - 1) = (1 - \alpha)K, \tag{18}$$

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.

Eq. (15) and the budget constraint (13) imply that the consumption rate of a debt-free migrant (i.e., after time τ), is constant at

$$c^{b*} = w^* - \frac{r^*\alpha K e^{\rho\tau}}{1 - e^{-r^*(T-\tau)}}. \tag{19}$$

Moreover, the optimality condition (16) with respect to τ can be written as

$$\left[u(c^{b*}) - u(c_\tau^b)\right]e^{-\delta\tau} - (c_0^b)^{-\theta}(w^b - c_\tau^b)e^{-r\tau} + (c^{b*})^{-\theta}(w^* - c^{b*} - \rho\alpha K e^{\rho\tau})e^{-\delta\tau} = 0, \quad (20)$$

which states that when τ is optimally chosen, the cost (in terms of utility) of remaining in bondage an instant longer, $[u(c^{b*}) - u(c_\tau^b)]e^{-\delta\tau}$, must be equal to the benefit, $(c_0^b)^{-\theta}(w^b - c_\tau^b)e^{-r\tau} - (c^{b*})^{-\theta}(w^* - c^{b*} - \rho\alpha K e^{\rho\tau})e^{-\delta\tau}$, which is the utility value of net savings accumulated during this extra instant. Noting that $c_\tau^b = c_0^b e^{\frac{r-\delta}{\theta}\tau}$, eqs. (18), (19) and (20) can be solved for the optimal length of the debt-bondage phase, τ, the initial consumption rate, c_0^b, and the constant consumption rate after release from bondage as functions of the exogenous variables. Note that the migrant's consumption rate jumps to a higher level once he is released from bondage at time τ.

The discounted lifetime utility of a debt-bonded migrant is given by

$$U^{DB} = \frac{(c_0^b)^{1-\theta}}{1-\theta}\Big[\frac{e^{g\tau} - 1}{g}\Big] + \frac{(c^{b*})^{1-\theta}}{1-\theta}\Big[\frac{e^{-\delta\tau} - e^{-\delta T}}{\delta}\Big], \quad (21)$$

where c_0^b, c^{b*}, and τ are optimally chosen.

2.3 Staying Permanently at Home

Another choice available to a worker is to simply stay permanently at home. On the assumption that he faces a constant rate of interest, ρ, equal to his rate of time preference, the optimal time path of consumption is flat with $c_t = w$. The discounted lifetime utility stemming from his optimal consumption program is then given by

$$U^{NM} = \frac{w^{1-\theta}}{1-\theta}\Big[\frac{1 - e^{-\delta T}}{\delta}\Big], \quad (22)$$

where NM stands for "no migration".

3 The Three Options

A worker in the source country has three options: (a) no migration (NM), resulting in utility U^{NM}, (b) self-financed migration (SF), resulting in utility U^{SF}, and (c) debt-bonded migration (DB), giving rise to a utility level U^{DB}. As in Djajić and Vinogradova (2014), the relationship among these options is illustrated in figure 1 on the basis of a numerical example. The ratio of the host- to source-country wage is measured along the vertical axis and the ratio of the migration cost to the source-country wage on the horizontal axis. The SF=NM locus displays combinations of w^*/w and K/w such that a potential migrant is indifferent between self-financed migration and no migration. The schedule is drawn for $T = 30$ years, $\theta = 0.95$, and $\delta = \rho = r^* = 5\%$ per annum, while wages are measured as flows per week, with the source-country wage normalized to unity.[5] Let us consider first the case in which $\alpha = 0$. This is when a migrant has no possibility of obtaining any financial support from his family network. Above and to the left of the SF=NM schedule, $U^{SF} > U^{NM}$, so that he is better off migrating under the SF arrangement rather than choosing NM. In the region below and to the right of SF=NM it does not pay to go abroad as an SF migrant.

[5]If we were to choose a longer time horizon, T, an increase in K would require a smaller increase in w^* to keep the utility of SF equal to that of NM, making the SF=NM schedule flatter. By contrast, an increase in the degree of concavity of the utility function, as measured by θ, makes the SF=NM schedule steeper i.e., for any given increase in K, it requires a larger increase in future income (and hence w^*) to keep the agent indifferent between SF and NM). Estimates of θ vary significantly across studies, depending on the data used and the empirical strategy. Chetty (2006) examines some of the factors that explain this wide range of estimates. He reports that the mean estimate in the literature is $\theta = 0.71$, while noting that studies which combine the benefits of exogenous variation with the structural lifecycle approach, such as Blundell, Duncan, and Meghir (1998), with its estimate of $\theta = 0.93$, provide perhaps the most credible microeconomic estimates.

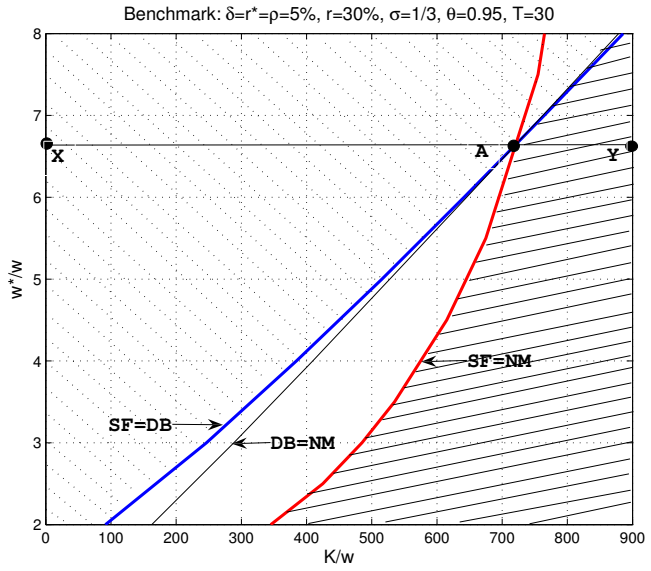

Figure 1: Optimal arrangements for financing migration costs.

The SF=DB locus plots the combinations of w^*/w and K/w such that a worker is indifferent between SF and DB under the assumptions that the smuggling organization charges $r = 30\%$ per annum and offers a bonded wage which is only two thirds of the market wage in the host country (i.e, $w^b = (1-\sigma)w^*$, where $\sigma = 1/3$). From the perspective of a potential migrant, the appeal of a debt-bondage arrangement stems from the fact that this financing mode gets him sooner to the foreign, high-wage country. For any given σ, getting abroad sooner has a greater impact on his welfare, the larger is w^*. High interest charges imposed by the smuggling organization are an offsetting disadvantage, the weight of which is heavier, the higher the cost of migration. For given values of r and σ, this implies a positive relationship between w^* and K that makes potential migrants indifferent between SF and DB options. For combinations of w^* and K above the SF=DB locus, DB is preferred over SF and vice versa. Finally,

agents are indifferent between DB and NM along the positively sloped DB=NM schedule. $U^{DB} > U^{NM}$ above it and $U^{DB} < U^{NM}$ below it.

It can be shown that all three schedules intersect at point A and that in the neighborhood of the intersection point, the SF=DB schedule is flatter than the DB=NM schedule, which is in turn flatter than the SF=NM schedule (see Djajić and Vinogradova, 2014 for details). The three schedules separate figure 1 into three distinct regions. For combinations of w^* and K which fall into the dotted area above the SF=DB schedule to the left of point A and above the DB=NM schedule to the right of A, the DB option is optimal. SF is optimal for combinations of w^* and K in the white, unshaded area between the SF=DB and the SF=NM schedules below and to the left of point A and NM is optimal in the remaining area shaded by thin diagonal lines.

The figure shows, as one would expect, that NM is the best option when K is high and w^* insufficiently attractive to warrant going abroad. By contrast, when K is low and w^* is high, DB is optimal. With a low K and a high w^*, the debt burden is not too heavy and the loan can be repaid relatively quickly out of earnings abroad, even if the rate of interest charged by the smuggler is rather excessive. For somewhat higher values of K and/or lower w^*, SF dominates DB in the unshaded region. This is because a higher K imposes a larger debt burden that must be serviced under DB at a high rate of interest, while a reduction in w^* relative to w reduces the benefit of getting abroad sooner as a bonded laborer. SF is then the optimal way to pay for K.

4 Financial Support from the Family

The example presented in figure 1 is based on the assumption that $\alpha = 0$. When $\alpha > 0$, the ability to borrow αK from a network of family and friends obviously facilitates migration and increases the utility of a migrant, regardless of whether the balance of migration costs, $(1 - \alpha)K$, is self-financed or funded by entering into a debt-bondage agreement with a smuggling organization. In the case of self-finance, partial support from the family enables the migrant to pay for migration costs sooner and start earning the high foreign wage earlier in life. In the case of debt bondage, family support serves to substitute low-interest debt, owed to the family, for high-interest debt owed to the smuggler. In addition, a family loan helps the migrant get out of bondage sooner and enables him to repay the amount owed to the family while earning w^* rather than the lower, bonded wage $w^b = (1 - \sigma)w^*$.

The financing role of a family network is of paramount importance when it comes to long-haul routes, characterized by high values of K/w and w^*/w, such as in the case of Chinese migration to the West. The history of that migration stream is one of early migrants providing newcomers with partial (and in many cases total) financing of their migration costs (see Kwong, 1997 and Gao, 2004). The implications of financial support from the family network for the relative attractiveness of SF, DB, and NM are illustrated in figure 2. The dashed lines correspond to the benchmark case ($\alpha = 0$), while the solid lines pertain to a situation in which a family loan covers 20% of migration costs (i.e. $\alpha = 0.2$). Note that family support makes debt-bonded migration more attractive in relation to *both* SF and NM, expanding the DB area in figure 2 by EABICA'F. The

SF area, represented by EAG in the absence of family support, becomes FA'D. The NM area, which was the region GABICH in the absence of family support, shrinks to DA'CH.

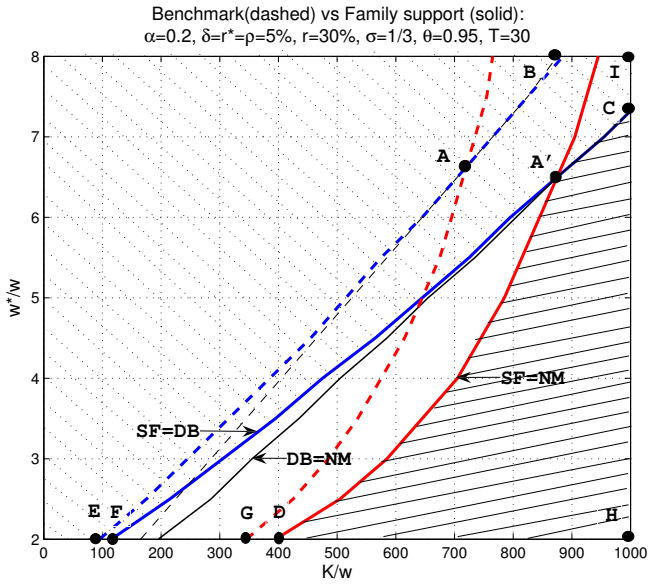

Figure 2: Family support with $\alpha = 20\%$.

The figure illustrates three important points. First, as shown by the magnitude of the shifts of the three schedules, even a small amount of financial support from the family (20% of K) has a substantial impact on the optimal choice with respect to SF, DB, and NM. Second, the fact that the NM area shrinks, implies that access to credit on reasonable terms contributes to an increase in the flow of migrants to the advanced countries. This is likely to take the form of both self-financed and debt-bonded migration from the relatively better off sending countries, characterized by relatively low values of w^*/w that lie below point A, and debt-bonded migration from poorer countries whose migrants face higher values of K/w and w^*/w.[6]

[6]According to Gao and Poisson (2005, p. 49), the vast majority of Chinese immigrants arriving in France

The third point illustrated by figure 2 is that debt-bondage becomes the preferred financing option over self-finance for a wider range of combinations of w^* and K. This result stems from the fact that if an individual is initially indifferent between SF and DB, a family loan raises the utility of DB by more than that of SF. To confirm this, note that for a self-financed migrant, the welfare impact of a loan amounting to one unit of the numeraire obtained at time ϕ (the moment of departure), is simply $\Delta U^{SF} = u'(c_{\phi-}) - u'(c^*_{\phi+})$. This is the difference between his marginal utility of consumption the moment just before and just after migration under the SF arrangement. As optimal consumption *jumps to a higher level* after migration at time ϕ, $u'(c_{\phi-}) > u'(c^*_{\phi+})$ and so $\Delta U^{SF} > 0$. Similarly, a family loan in the same amount changes the welfare of a DB migrant by $\Delta U^{DB} = u'(c^b_0) - u'(c^{b*}_{\tau+})$. This is clearly positive because his consumption at the beginning of debt-bondage, c^b_0, is lower than that after release from bondage, $c^{b*}_{\tau+}$, guaranteeing that $u'(c^b_0) > u'(c^{b*}_{\tau+})$. To compare ΔU^{SF} with ΔU^{DB}, recall that in the case of no family support, a migrant's consumption abroad under SF is identical to that of a DB migrant after release from bondage. Both consume at the rate w^* when $\delta = r^*$. Thus, to determine the magnitude of ΔU^{SF} relative to ΔU^{DB} along the SF=DB schedule, we need to compare $c_{\phi-}$ with c^b_0. It can be shown that all along the SF=DB locus, an SF migrant consumes more just before migration than a DB migrant does at the

in the late 1990s, facing relatively high values of K/w and w^*/w, were in fact indebted. Most of the migrants were from Zhejiang and practically all of them (479 out of 500 respondents) were indebted on arrival. For a majority of these migrants, the debts were in the range between 14 000 and 20 000 euros. Unfortunately, the data set used by Gao and Poisson (2005) does not identify the source of credit (i.e., human smugglers, family members or village associations). In this context, it is also interesting to note that roughly 90% of Chinese immigrants living in Florence were born in the Wenzhou region of Zhejiang (Gao, 2004). The fact that Chinese migrants in the West tend to be heavily indebted and to originate from very specific regions of China, suggests that financial support from the family (and other forms of support provided by their migration networks at the destination) are playing a very important role in facilitating migration.

beginning of debt-bondage.[7] This implies that $u'(c_{\phi-}) < u'(c_0^b)$ and so $\Delta U^{DB} > \Delta U^{SF}$: Financial support from the family therefore makes debt-bondage more attractive relative to self-finance, shifting the SF=DB schedule down and to the right, as shown in figure 2.

We assumed to this point that an agent's initial holdings of assets, A, are equal to zero. If we were to relax this assumption, we would find that one additional unit of wealth increases utility of a DB migrant by $u'(c_0^b)$, increases utility of an SF migrant by $u'(c_0)$, and raises the utility of a non-migrant by $u'(w)$. We know from the previous discussion that $w > c_0 > c_0^b$. This implies that if an agent is indifferent between SF and DB or NM and DB, an extra unit of wealth raises U^{DB} relative to U^{SF} and U^{NM}, causing the SF=DB and DB=NM schedules to shift down and to the right. Similarly, because an extra unit of wealth increases the utility of SF relative to that of NM, it causes the SF=NM schedule to shift down and to the right. The implications of an increase in the initial asset holdings for the optimal migration strategy are therefore very similar to those of an increase in the amount of financial support from the family, depicted in figure 2.

[7] The formal proof is the following. Consider the optimality conditions with respect to ϕ, in the case of SF, and with respect to τ, in the case of DB. Since both of them are equal to zero for optimally chosen ϕ and τ, we can write, $u(c_\phi) - u(w^*) + c_\phi^{-\theta}(w - c_\phi + \rho K) = u(c_\tau^b) - u(w^*) + (c_\tau^b)^{-\theta}(w^b - c_\tau^b)$. The left-hand side is a monotone decreasing function of c_ϕ, while the right-hand side is a monotone decreasing function of c_τ^b, by concavity of the utility function. Suppose that $c_\phi = c_\tau^b$. Then, substituting c_ϕ for c_τ^b on RHS of the condition above, we obtain $u(c_\phi) + c_\phi^{-\theta}(w - c_\phi + \rho K) < u(c_\phi) + (c_\phi)^{-\theta}(w^b - c_\phi)$, since $w + \rho K < w^b$ by assumption. In order for the equality to be restored, the RHS needs to fall. Given that it is a monotone decreasing function of c_τ^b, a fall in RHS can occur only if c_τ^b rises. Therefore, $c_\tau^b > c_\phi$. Following similar steps and taking into account the fact that $U^{SF} = U^{DB}$ along SF=DB locus, one can show that $c_0^b < c_0$.

5 Conclusion

Barriers to immigration of low-skilled workers from developing countries prevent many potential migrants from realizing their aspirations to work in an advanced country. With very low home-country wages in relation to the cost of undocumented migration, the opportunity to migrate often hinges on becoming indebted to a human smuggling organization or family and friends. This paper examines the conditions under which migration is optimal for an individual who lacks liquid assets, with a focus on alternative options for financing migration costs. One is by accumulating the required amount of savings out of source-country income, with or without financial support from the family or social network. The other is debt-bonded migration, which involves borrowing from a smuggling organization and paying off the loan while working in the host country.

The possibility of borrowing from family and friends (or financial institutions) on reasonable terms is shown to make migration more attractive in relation to the "no-migration" option. Under the self-finance arrangement, it enables the migrant to get abroad earlier in life and earn the high foreign wage over a longer period of time. In the case of debt-bonded migration, a family loan allows the individual to get out of bondage sooner and repay the family loan while earning the free-market wage rather than the relatively-lower bonded wage. Interestingly, with partial financial support from the family, debt bondage becomes more attractive, not only in relation to the option of remaining permanently at home, but also in relation to self-financed migration. Larger initial asset holdings are found to have similar implications for the optimal migration strategy.

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