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A guest-worker program can be a very flexible and convenient way of meeting labor shortages in a host country, assuming that the migrants obey the rules. This paper investigates the conditions under which guest workers have sufficient incentives for voluntary return to their country of origin when their work permits expire. The analysis is conducted in the context of a lenient enforcement regime that avoids deportations of undocumented aliens. It relies instead on eligibility criteria and pricing instruments, such as partial withholding of salary and an exit tax for those who overstay, to provide adequate incentives for voluntary return at the end of the contract period.

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A guest-worker program can be a very flexible and convenient way of meeting labor shortages in a host country, assuming that the migrants obey the rules. This paper investigates the conditions under which guest workers have sufficient incentives for voluntary return to their country of origin when their work permits expire. The analysis is conducted in the context of a lenient enforcement regime that avoids deportations of undocumented aliens. It relies instead on eligibility criteria and pricing instruments, such as partial withholding of salary and an exit tax for those who overstay, to provide adequate incentives for voluntary return at the end of the contract period.

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1 Introduction

Guest-worker programs of various shapes and forms have been utilized extensively since World War II to meet shortages of low and semi-skilled labor in the advanced and rapidly growing emerging economies. The *Bracero* program (1942-1964), established to recruit Mexican workers for temporary employment in the U.S.A., is one of the early examples. In the 1960's and 1970's Western European countries introduced temporary migration schemes to meet the growing demand for labor in the manufacturing sector. Following the oil price shock of 1973, these schemes were wound down. At the same time the oil-producing countries in the Middle East, especially those with a small indigenous labor force, expanded their temporary migration programs to the point where foreign workers now account for most (and in some exceptional cases practically all) of the work force in the private sector (see Kapiszewski 2006). Rapid growth of the East Asian economies has also generated labor shortages in the late 1980's and 1990's. In the case of South Korea, Taiwan, Hong Kong, Singapore, Brunei, Japan, Thailand and Malaysia, the shortages have been addressed by recruiting temporary foreign workers or trainees to work in small scale manufacturing, construction, agriculture, food processing, and various labor-intensive service activities.

Temporary migration is an attractive mode of international labor mobility for the host countries. It enables the latter to meet labor shortages without having to make long-term commitments to foreign workers in relation to permanent settlement, political rights, and access to social programs. At the same time they offer much greater labor-market flexibility than permanent migration schemes.[1] An important concern for the policymakers, however, is that the migrants may not choose to go back when their work permit expires. As pointed out by Millbank (2006), a major problem that host countries

[1]Ethier (1985) provides a pioneering analysis of the welfare implications of guest-worker migration in a model of international trade. See also Schiff (2007, 2011), Winters *et al* (2003), Djajić (2013), Djajić, Michael and Vinogradova (2012), and Djajić and Michael (2013) for theoretical treatment and GAO (2006), Martin (2003), Martin and Titelbaum (2001), Abella (2006, 2009) and Ruhs (2006) for more descriptive analysis. An extensive discussion of the successes and failures of temporary migration programs in the past is provided by Ruhs (2002). Orrenius and Zavodny (2010), Djajić (2011), and Peri (2012) offer suggestions for reforming the current system in the U.S.

have to deal with is that guest workers who agree initially to the program rules may decide to overstay. East Asian economies have addressed this problem, in part, by applying very strict deportation measures. These measures, however, have proven to be very costly, both in economic terms[2] and in terms of a country's human-rights image, as deportations are sometimes fiercely resisted by the deportees, resulting even in fatalities related to the procedure. Advanced Western countries are therefore rather reluctant to resort to deportations. Notable exceptions are cases of illegal aliens who have completed serving a prison sentence related to criminal activities.[3]

The focus of the present study is on the problem of determining under what conditions temporary contract workers have an incentive to overstay in the host country beyond the expiration of their work permit. The importance of this question from the perspective of the policymakers varies from one country to another. In East Asian economies, as well as in some of the labor-importing countries of the Middle East, the possibility that a temporary migrant may remain in the country without proper documentation is a very serious concern. *Permanent* settlement of foreigners who were admitted as *temporary*, low-skilled workers is particularly alarming for the authorities. It can have an irreversible impact on the ethnic composition of the population. It can also threaten the political and economic status of the natives and the country's cultural homogeneity. By contrast, other economies that host temporary foreign workers, such the states in Western Europe and North America, are less alarmed by the prospect of a temporary migrant trying to remain in the country permanently. Nonetheless, even in these relatively more permissive immigration regimes, the authorities are becoming increasingly vigilant when it comes to enforcing legislation pertaining to illegal immigration. This suggests that the guest-

[2]According to the Associated Press (2011), the cost of apprehending, processing, detaining, and deporting an illegal alien in the U.S.A. is estimated to be $ 12,500 per person. In the UK, between 1998 and 2009, 111,265 illegal immigrants have been deported at the average cost of £11,000 per person (BBC, 2009). In Norway, as reported by Berglund (2013), each deportation costs on average NOK 50,000 (USD 9,000). This is due to the required paperwork and transport involved, often including police escorts.

[3]Due to budget cuts, non-criminal illegal aliens, awaiting deportation in the U.S. detention system, were gradually being released in February 2013. According to Randy Beck, Justice Thomas O. Marshall chair of constitutional law at the University of Georgia, the problem is essentially financial: "Look, we don't have the resources to deport everybody. We have to pick and choose and we're just going to choose people who have committed serious offenses" (Hamilton, 2013).

worker programs of the future will need to be designed with greater emphasis on ensuring that the temporary foreign workers return to their countries of origin when they are no longer needed.

The present study considers the problem facing a potential migrant who must choose whether to migrate to the host country as a temporary contract worker or to remain permanently at home. Should he choose to migrate, he must decide whether it is optimal to overstay or return voluntarily to his home country when the work permit expires. The framework of analysis is based on that developed in Section 2 of Djajić (2013) to investigate the conditions under which migrants prefer to return voluntarily rather than stay permanently abroad or overstay for just some time. The present study differs, however, both with respect to its objective and in terms of the policy instruments assumed to be available to the immigration authorities of the host country. The purpose of the study is two-fold: 1) To examine the factors that determine the optimal duration of the overstay period when adequate incentives for voluntary return at the end of a worker's contract are not in place and 2) to characterize the policy environment that results in strict compliance with the program rules. With respect to tools of immigration policy, we consider two additional policy instruments that can help induce guest workers to return home voluntarily at the end of their contract. These are a penalty for having overstayed, which is imposed on an illegal alien when exiting the country, and a salary withholding scheme. Penalties for overstaying are very common in both Western and Asian countries. They often consist of monetary fines and/or other forms of punishment, such as a jail sentence or a ban on reentry, which may be for a specific period of time or permanent. We also extend the framework of analysis used in previous studies by considering explicitly the retirement phase of a worker's planning horizon and examining its role in influencing migration decisions.

The remainder of the paper has the following structure. Section 2 defines the maximization problem of a guest worker who intends to return voluntarily at the end of the contract period and of a guest worker who intends to overstay for an additional x units of time, where x is optimally chosen. In Section 3, discounted lifetime utility associ-

ated with these two choices is compared with that of a non-migrant to characterize the conditions under which a temporary migration program is able to attract participants and induce them to return to their countries of origin when the work permit expires. Should it be optimal to overstay, our model relates the duration of the undocumented phase of the migrant's stay abroad to the immigration policies of the host country and other parameters of the model that characterize the environment facing a foreign worker. Section 4 summarizes the main policy implications of the model and offers suggestions for future research.

2 A Guest Worker's Problem

Consider a two-country world consisting of a source country (S) and a host country (H). Suppose that H recruits workers from S on temporary contracts that require each migrant to work for his contractual employer for τ units of time. Some countries allow migrants to renew their work permits, provided the request is supported by the employer. This is still the case, for example, in most of the Gulf cooperation Council (GCC) States. In other countries, work (or trainee) permits of low-skilled migrants are non-renewable or can be renewed for only a specific period of time: The maximum duration of stay for low-skilled guest workers (or trainees) is three years in Japan, four years in Singapore and on Cyprus, five years in Israel and Malaysia, and 6 years in South Korea and Taiwan. In what follows, we shall assume that the work permits are valid for τ units of time, non-renewable, and made available to migrants at what we define to be the age of 0 (i.e., the beginning of the planning horizon).

To provide a strong incentive for contract completion *and* voluntary return to the source country, we assume that, as is often the case in the East Asian migration programs, the employer withholds a fraction α of a migrant's wage for the entire duration of the contract period.[4] Let us assume that the withheld earnings are returned to the migrant

[4]In Malaysia, it is common to pay foreign domestic workers only at the end of the standard two-year

(with interest) at time τ, conditional on voluntary departure. Thus a worker who intends to return to the source country at time τ is not affected by the withholding scheme, as it essentially serves as a savings plan. The withholding measure bites only in the event the worker chooses to overstay.

Guest workers earn the foreign nominal wage, w^*, and the foreign rate of return, r^*, on accumulated savings (including withheld earnings). When a worker returns to S, he works for the wage $w(< w^*)$ and invests the repatriated savings in an activity that yields the rate of return $r > r^*$.[5] We shall assume that w^*, w, r^* and r are all constant. At time T, a worker goes into retirement until the end of the planing horizon at $t = T + R$, where R is the duration of the retirement phase. Retiring in the country of origin is assumed to offer a flow of benefits which has a monetary value of b. This flow may consist of public-sector transfers or returns on social capital that the migrant enjoys in his community of origin.

2.1 A Migrant Who Obeys the Rules of the Program

For a guest worker who intends to return voluntarily at the end of the contract period, the problem is to maximize V^m, the discounted utility from consumption abroad (from time 0 to τ) and at home (from time τ to $T + R$), by choosing the optimal consumption rate at each point in time.

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

contract. This prevents workers from switching employers or reporting abuses. The practice of withholding part of a worker's salary to guarantee contract completion is a common practice in the Middle East and East Asia.

[5] Evidence on the rates of return on repatriated assets of returnees is scarce. Nonetheless, these rates seem to be (or should in principle be) considerably higher than the rates available on savings in the host country (see, e.g., Penny (1986), Swallow and Brokken (1987), de Mel, McKenzie and Woodruff (2008), and Udry and Anagal (2006)).

with c_t^* and c_t being the rates of consumption abroad and after return to S, respectively.[6] The migrant's rate of time preference, δ, is assumed to be constant and the utility function is concave, twice differentiable, and invariant with respect to the location where consumption takes place. To simplify the analysis, we shall assume that $\delta = r^* < r$.

Utility is maximized subject to the budget constraint which requires that the savings accumulated abroad (including withheld wages), net of migration costs, plus any initial asset holdings, A_0, are equal to the appropriately discounted excess of consumption over wage income after return. The cost of migration is assumed to be a constant $K \leq A_0$.[7] Using the date of return τ as the point of reference, we may express a guest-worker's budget constraint as

$$\int_0^\tau (w^* - p_t^* c_t^*) e^{r^* t} dt - (K - A_0) e^{r^* \tau} = -\int_\tau^T (w - p_t c_t) e^{-r(t-\tau)} dt - \int_T^{T+R} (b - p_t c_t) e^{-r(t-\tau)} dt, \tag{2}$$

where p_t and p_t^* are the prices at t of the unique consumption good available in both S and H, respectively. Prices are measured in terms of the *numéraire*, call it the Dollar. The Lagrangian associated with this maximization problem may be written as

$$L = \int_0^\tau u(c_t^*) e^{-\delta t} dt + \int_\tau^{T+R} u(c_t) e^{-\delta t} dt + \lambda \Big\{ \int_0^\tau (w^* - p_t^* c_t^*) e^{-r^* t} dt - (K - A_0) + \\ + e^{-r^* \tau} \int_\tau^T (w - p_t c_t) e^{-r(t-\tau)} dt + e^{-r^* \tau} \int_T^{T+R} (b - p_t c_t) e^{-r(t-\tau)} dt \Big\}$$

The first order conditions consist of

$$\frac{\partial L}{\partial c_t^*} = u'(c_t^*) e^{-\delta t} - \lambda p_t^* e^{-r^* t} = 0, \quad t \in [0, \tau) \tag{3}$$

$$\frac{\partial L}{\partial c_t} = u'(c_t) e^{-\delta t} - \lambda p_t e^{-rt + (r - r^*)\tau} = 0, \quad t \in (\tau, T + R] \tag{4}$$

[6] If w^* and τ are large enough, a migrant may prefer to return to S before time τ (see Djajić (2010)). For realistic values of the parameters that characterize the conditions facing a guest workers, however, they typically wish to remain abroad until the completion of their contract. Cases of migrants returning to S *before* time τ usually occur as a result of unexpected developments at home or at the workplace. We shall exclude such cases by assumption.

[7] For a theoretical analysis of the problem facing migrants who are liquidity constrained and need to borrow funds to pay for migration costs, see Friebel and Guriev (2006) and Djajić and Vinogradova (2011, 2014.)

and the budget constraint (2). Let us simplify the analysis by assuming that the prices of consumption abroad and at home are constant at the levels p^* and p, respectively. We can then write eqs. (3) - (4) as

$$u'(c_t^*) = p^*\lambda, \tag{5}$$

$$u'(c_t) = p\lambda e^{-(r-r^*)(t-\tau)}. \tag{6}$$

With $\delta = r^*$, we observe in (5) that $u'(c_t)$ is constant. The corresponding rate of consumption c_t^* is therefore also constant at c^*. Under the realistic assumption that $p < p^*$, eqs. (5) and (6) imply that return to S at time τ triggers a jump in consumption to a higher rate. Letting the utility function take the form $u(x) = x^{1-\theta}/(1-\theta)$ and using (5) and (6), we may write $c_\tau = c^*(p^*/p)^{1/\theta} > c^*$. Along with eq. (6), this implies that

$$c_t = c^*(p^*/p)^{1/\theta} e^{(\frac{r-r^*}{\theta})(t-\tau)}, \quad t \in (\tau, T+R], \tag{7}$$

where $1/\theta$ is the elasticity of intertemporal consumption substitution. Using (7), the budget constraint (2) can be written as

$$\begin{aligned}\frac{(w^* - p^*c^*)}{r^*}(e^{r^*\tau} - 1) - (K - A_0)e^{r^*\tau} - \frac{pc^*(p^*/p)^{1/\theta}}{g}(e^{g(T+R-\tau)} - 1) + \\ + \frac{w(1 - e^{-r(T-\tau)}) + b(e^{-r(T-\tau)} - e^{-r(T+R-\tau)})}{r} = 0,\end{aligned} \tag{8}$$

where $g = [(r-\delta)/\theta] - r \gtreqless 0$. This yields the solution for c^* as a function of the model's parameters: migration cost, K, the maximum allowed duration of stay abroad, τ, the foreign and domestic wage rates, w^* and w, foreign and domestic commodity prices, p^* and p, initial asset holdings, A_0, the rate of return, r, on accumulated savings, the remaining working life, T, at the time of migration, and finally the duration of the retirement phase, R, and the flow of benefits, b, enjoyed by a retiree at home.

$$c^* = \frac{\frac{w^*(e^{r^*\tau}-1)}{r^*} + \frac{w(1-e^{-r(T-\tau)})}{r} + \frac{b(e^{-r(T-\tau)}-e^{-r(T+R-\tau)})}{r} - (K - A_0)\, e^{r^*\tau}}{\frac{p^*(e^{r^*\tau}-1)}{r^*} + \frac{p(e^{g(T+R-\tau)}-1)}{g}(\frac{p^*}{p})^{1/\theta}}. \tag{9}$$

Using eq. (9) in (7), and introducing the resulting expression into eq. (1) yields

$$V^m = \frac{(c^*)^{1-\theta}}{1-\theta}\left(\frac{1-e^{-\delta\tau}}{\delta}\right) + \frac{(c^*)^{1-\theta}(p^*/p)^{\frac{1-\theta}{\theta}}}{1-\theta}\left(\frac{e^{g(T+R-\tau)-r^*\tau}-e^{-\delta\tau}}{g}\right). \qquad (10)$$

With c^* given by (9), this is the discounted level of utility enjoyed by a guest worker who obeys the rules of the program and returns to S at $t = \tau$.

2.2 The Problem Facing an Overstayer

If a guest worker remains abroad after the work permit expires at time τ, he forfeits the withheld wages, $\int_0^\tau \alpha w^* e^{r^*(\tau-t)}dt$, and faces a fine in the amount ϕ, should he try to exit the host country after having overstayed. Penalties for overstaying can take different forms: They can be pecuniary in nature and/or involve imprisonment, as in Saudi Arabia, Singapore, Malaysia, South Korea, and other Asian countries (see Vinogradova, 2011), or they may take the form of a ban on reentry for a certain number years, as for example, in Japan, the U.S.A. and the states of Western Europe.[8] Regardless of the form of penalty, for it to be fully effective, it must not exceed the cost of avoiding the penalty, should it be a fine or a prison term, by clandestinely exiting the host country. The cost of a clandestine exit can be very high, as in the case of Japan and South Korea, or much lower, as in countries with penetrable land borders, such as the U.S.A. or the Schengen zone. In what follows, we shall assume that ϕ is below the cost of a clandestine exit or the cost of an undocumented entry in the event the penalty is in the form of a ban on reentry.

As is the case in most countries, overstaying also implies that once the work permit

[8] An individual residing unlawfully in the U.S.A. for more than 180 days, but less than one year, is barred from reentering for a period of three years. If the person is unlawfully present for one year or more, upon departing, he or she becomes inadmissible for ten years. Penalties for overstaying can take many different shapes and forms. In the case of New Zealand's temporary migration program, the so-called Recognised Seasonal Employer (RSE) scheme, which recruits workers from a number of Pacific island economies, an effective penalty for overstaying can in fact be imposed by the community at origin. As pointed out by Gibson and McKenzie (2013), competition for placement in the program among communities in the countries of origin gives rise to social pressures on migrants not to overstay, as that would create a negative reputation for one's community and jeopardize migration opportunities for other community members.

expires at time τ, the migrant is obliged to seek employment in the underground economy and earns a lower wage: Not the wage w^*, but rather the wage $w^u = w^*(1-\sigma) > w$, where the fraction σ represents the wage penalty associated with having undocumented status in the labor market of the host country. For the United States, studies conducted by Rivera-Batiz (1999, 2000) and Kossoudji and Cobb-Clark (2002) suggest that the wage penalty associated with undocumented status was roughly 20% in the 1990s. The wage penalty, σ, is likely to be higher in economies with stricter internal enforcement measures.

Discounted utility of a guest worker who is determined to overstay in H for an additional x units of time can be obtained by solving the following optimization problem:

$$\max_{c_t^*, c_t, x} \quad V^{os} = \int_0^{\tau+x} \frac{(c_t^{*os})^{1-\theta}}{1-\theta} e^{-\delta t} dt + \int_{\tau+x}^{T+R} \frac{(c_t^{os})^{1-\theta}}{1-\theta} e^{-\delta t} dt, \tag{11}$$

subject to

$$\begin{aligned} & A_0 - K - \phi e^{-r^*(\tau+x)} + \int_0^{\tau} [w^*(1-\alpha) - p^* c_t^{*os}] e^{-r^* t} dt + \\ & + \int_{\tau}^{\tau+x} [w^*(1-\sigma) - p^* c_t^{*os}] e^{-r^* t} dt + e^{-r^*(\tau+x)} \int_{\tau+x}^{T} [w - p c_t^{os}] e^{-r(t-\tau-x)} dt + \\ & + e^{-r^*(\tau+x)} \int_{T}^{T+R} [b - p c_t^{os}] e^{-r(t-\tau-x)} dt = 0, \end{aligned} \tag{12}$$

where c_t^{*os} and c_t^{os} are the consumption rates abroad and at home of a worker who intends to overstay in H, with the duration of the undocumented stay, x, optimally chosen. This problem has a number of features similar to the one examined in the Appendix of Djajić (2013). In the present study, however, we consider a richer policy environment that includes withholding of wages, which are forfeited if the migrant does not leave at the end of the contract period, and a penalty for violating the rules of the program that consists of a fine, ϕ, if and when the worker decides to exit the host country. Moreover, in addition to studying the conditions under which a guest worker has no incentive to overstay, we examine how the optimal duration of the undocumented phase is affected by the immigration policies of the host country and other parameters that influence a

migrant's behavior.

The Lagrangian associated with this problem is

$$L^{os} = \int_0^{\tau+x} \frac{(c_t^{*os})^{1-\theta}}{1-\theta} e^{-\delta t} dt + \int_{\tau+x}^{T+R} \frac{(c_t^{os})^{1-\theta}}{1-\theta} e^{-\delta t} dt + \lambda^{os} \Bigg\{ A_0 - K - \phi e^{-r^*(\tau+x)} +$$
$$+ \int_0^{\tau} [w^*(1-\alpha) - p^* c_t^{*os}] e^{-r^* t} dt + \int_{\tau}^{\tau+x} [w^*(1-\sigma) - p^* c_t^{*os}] e^{-r^* t} dt +$$
$$+ e^{-r^*(\tau+x)} \left[\int_{\tau+x}^{T} [w - p c_t^{os}] e^{-r(t-\tau-x)} dt + \int_{T}^{T+R} [b - p c_t^{os}] e^{-r(t-\tau-x)} dt \right] \Bigg\}. \quad (13)$$

The first-order conditions are:

$$\frac{\partial L^{os}}{\partial c_t^{*os}} = (c_t^{*os})^{-\theta} e^{-\delta t} - \lambda^{os} p^* e^{-r^* t} = 0, \quad (14)$$

$$\frac{\partial L^{os}}{\partial c_t^{os}} = (c_t^{os})^{-\theta} e^{-\delta t} - \lambda^{os} p e^{-rt + (r-r^*)(\tau+x)} = 0, \quad (15)$$

$$\frac{\partial L^{os}}{\partial x} = \left[\frac{(c_{\tau+x}^{*os})^{1-\theta}}{1-\theta} - \frac{(c_{\tau+x}^{os})^{1-\theta}}{1-\theta} \right] e^{-\delta(\tau+x)} + \quad (16)$$
$$+ \lambda^{os} e^{-r^*(\tau+x)} \Big\{ \phi r^* + w^*(1-\sigma) - p^* c_{\tau+x}^{*os} - w + p c_{\tau+x}^{os} +$$
$$+ (r - r^*) \left[\int_{\tau+x}^{T} [w - p c_t^{os}] \, e^{-r(t-\tau-x)} dt + \int_{T}^{T+R} [b - p c_t^{os}] e^{-r(t-\tau-x)} dt \right] \Big\} = 0, \quad (17)$$

and the budget constraint (12). Eq. (14) implies that, with $\delta = r^*$, the consumption rate abroad of a guest worker who chooses to overstay is constant at the rate $c^{*os} = (p^* \lambda^{os})^{-1/\theta}$, while eqs. (14) and (15) imply that his consumption rate after return to the source country is

$$c_t^{os} = c^{*os} (p^*/p)^{1/\theta} e^{(\frac{r-r^*}{\theta})(t-\tau-x)}, \quad t \in [\tau + x, T]. \quad (18)$$

With the aid of (18) and noting that $\lambda^{os} = \frac{(c^{*os})^{-\theta}}{p^*}$, we can express (17) as

$$\frac{(c^{*os})^{1-\theta}}{1-\theta}\left[1-\left(\frac{p^*}{p}\right)^{\frac{1-\theta}{\theta}}\right]+\frac{(c^{*os})^{-\theta}}{p^*}\Bigg\{\phi r^*+w^*(1-\sigma)-w-$$
$$-p^*c^{*os}\left[1-\left(\frac{p^*}{p}\right)^{\frac{1-\theta}{\theta}}\right]+(r-r^*)\Big[w\frac{1-e^{-r(T-\tau-x)}}{r}-$$
$$-p^*c^{*os}\left(\frac{p^*}{p}\right)^{\frac{1-\theta}{\theta}}\frac{e^{e^{g(T+R-\tau-x)}}-1}{g}+b\frac{e^{-r(T-\tau-x)}-e^{-r(T+R-\tau-x)}}{r}\Big]\Bigg\}=0, \quad (19)$$

which enables us to write:

$$p^*c^{*os}=\frac{w\left[1-\frac{(r-r^*)(1-e^{-r(T-\tau-x)})}{r}\right]-w^*(1-\sigma)-\phi r^*-(r-r^*)b\frac{1-e^{-rR}}{r}e^{-r(T-\tau-x)}}{\frac{\theta}{1-\theta}\left(1-\left(\frac{p^*}{p}\right)^{\frac{1-\theta}{\theta}}\right)-(r-r^*)\left(\frac{p^*}{p}\right)^{\frac{1-\theta}{\theta}}\frac{e^{g(T+R-\tau-x)}-1}{g}}. \quad (20)$$

Using (18) in the budget constraint (12), we obtain

$$p^*c^{*os}=\Big\{A_0-K-\phi e^{-r^*(\tau+x)}+w^*\left[\frac{(1-\alpha)(1-e^{-r^*\tau})+(1-\sigma)(e^{-r^*\tau}-e^{-r^*(\tau+x)})}{r^*}\right]+$$
$$+e^{-r^*(\tau+x)}\left[w\frac{1-e^{-r(T-\tau-x)}}{r}+b\frac{1-e^{-rR}}{r}e^{-r(T-\tau-x)}\right]\Big\}\Big/$$
$$\left\{\frac{1-e^{-r^*(\tau+x)}}{r^*}+\left(\frac{p^*}{p}\right)^{\frac{1-\theta}{\theta}}e^{-r^*(\tau+x)}\frac{e^{g(T+R-\tau-x)}-1}{g}\right\}. \quad (21)$$

Finally, equating (20) to (21), we can solve for the optimal return date, $\tau + x$. Using these solutions in (11) yields the discounted welfare, V^{os}, of a guest worker who overstays in H until he finds it optimal to return to S.

2.3 Utility of a Non-Migrant

If a worker chooses not to migrate, his problem is to

$$\max_{c_t^n} \quad V^n=\int_0^{T+R}\frac{(c_t^n)^{1-\theta}}{1-\theta}e^{-\delta t}dt \quad (22)$$

subject to the budget constraint

$$A_0 + \int_0^T (w - pc_t^n)e^{-rt}dt + \int_T^{T+R} (b - pc_t^n)e^{-rt}dt = 0, \tag{23}$$

where c_t^n is a non-migrant's consumption rate. The Lagrangian is given by

$$L^n = \int_0^T \frac{(c_t^n)^{1-\theta}}{1-\theta} e^{-\delta t}dt + \lambda^n \left[A_0 + \int_0^T (w - pc_t^n)e^{-rt}dt + \int_T^{T+R} (b - pc_t^n)e^{-rt}dt \right].$$

The first-order conditions consist of

$$\frac{\partial L^n}{\partial c_t^n} = (c_t^n)^{-\theta} e^{-\delta t} - \lambda^n p e^{-rt} = 0, \tag{24}$$

and the budget constraint (23). We can use eqs. (23) and (24) to solve for the initial consumption rate of a non-migrant,

$$c_0^n = \frac{[A_0 + \frac{w}{r}(1 - e^{-rT}) + \frac{b}{r}(e^{-rT} - e^{-r(T+R)})]g}{p(e^{g(T+R)} - 1)}, \tag{25}$$

and his discounted lifetime utility

$$V^n = \int_0^{T+R} \frac{[c_0^n e^{\frac{r-\delta}{\theta}t}]^{1-\theta}}{1-\theta} e^{-\delta t}dt = \frac{(c_0^n)^{1-\theta}}{1-\theta} \frac{(e^{g(T+R)} - 1)}{g}, \tag{26}$$

with c_0^n given by (25) and $g = (r - \delta)/\theta - r \gtreqless 0$.

3 Temporary Migration with No Overstays

The objective of this paper is two-fold. To examine the conditions under which temporary migrants, who are recruited on a contract of the duration τ, have no incentive to overstay and, second, to study the relationship between immigration policies and the optimal duration of the overstay period if the incentives for voluntary return happen to be inadequate. In addressing these related problems, we compare the discounted utility of a temporary migrant who abides by the rules of the program, with those of a non-migrant

and of a guest worker who intends to overstay in H as an illegal alien for x additional units of time, where x is optimally chosen. From an expositional point of view, it is most illuminating to examine this problem by means of numerical simulations, using a specific example. Our choice of parameter values for this exercise is intended to reflect the conditions facing migrants from South and South-East Asia who work on temporary contracts in the manufacturing, construction and various service sectors of the economies in the Middle East and East Asia.

Without any loss of generality, we normalize w, the wage per year in S, and the country's price level, p, to unity. For the benchmark case, we assume that $r^* = \delta = .04$ per year, $r = .06$, and $\theta = 0.95$.[9] Working life, T, from the time of migration is set at $T = 40$ years and the retirement period R is assumed to be 10 years, with retirement benefits, b, enjoyed by a returnee in the source country set equal to 50% of w. The cost of living in H is is assumed to be twice as high in relation to that in S ($p^* = 2$), initial liquid asset holdings are assumed to be equivalent to two years of wages in S ($A_0 = 2$), the salary withholding rate of a guest worker is 10% ($\alpha = 0.1$), the wage of an illegal alien in H is assumed to be 20 percent lower than that of a documented guest worker ($\sigma = .20$), the penalty for overstaying is assumed to be 10% of a guest worker's yearly earnings in the host country ($\phi = 0.1$), and the cost of migration is equivalent to two year's wages in S ($K = 2$).[10]

The MO schedule in Figure 1 traces the combinations of τ and w^*, with other parameters at their benchmark levels, such that a migrant is indifferent between voluntarily returning to S at $t = \tau$ and overstaying beyond the expiration of the work permit for x

[9]Most estimates of θ seem to be in the range of 0.5 to 1.5 (see, e.g., Epstein and Zin (1991), Hansen and Singleton (1982), Keane and Wolpin (2001), Vissing-Jorgensen (2002), Favero (2005), and Kirdar (2012)). Values of θ in the range between 0.9 and 1.0 tend to generate, however, the most realistic patterns of saving behavior of temporary migrants (see Djajić, 2010).

[10]This is the amount, for instance, in the case of Thai migrants recruited on 2-year contracts in Taiwan (see Jones and Pardthaisong, 1999). As noted in the Human Development Report (2009, p.54), the recruitment fees for temporary employment contracts overseas can be an even larger multiple of source-country earnings. For foreign workers in Kuwait in 1995, Shah (1998) reports the following average costs of a visa: \$1733 for workers from Bangladesh, \$1116 for Indians, \$1294 for Pakistanis and \$645 for Sri Lankans. The visa, however, is only one element, with other fees charged by recruiting agents and travel expenses coming on top. In the case of temporary migration programs in North America, Western Europe, Australia and New Zealand, the migration costs are considerably lower and in many case at least partly covered by the employers.

additional years, where x is optimally chosen. Thus at each point along MO, $V^m = V^{os}$. The schedule is positively sloped because an increase in w^* makes overstaying more attractive, while an increase in the legal duration of stay in the host country reduces the incentive to overstay. This is not only because the amount of withheld wages that are lost by an overstayer increases with the duration of a guest-worker's contract, but also because a larger τ enables a migrant to save more while legally employed abroad. This reduces the incentive to stay still longer in the foreign country. Anywhere above (below) the MO schedule, overstaying yields a higher (lower) level of discounted utility than does a voluntary return to S at the end of the contract period. The optimal duration of the overstay phase, x, associated with each point on MO is displayed by the X locus in the panel on the right. It is positively related to the foreign wage along the MO schedule, as a higher values of w^* and τ along MO make the optimal duration of the overstay phase longer.

The MN schedule illustrates combinations of τ and w^* such that $V^m = V^n$. Thus at any point along MN, workers in S are indifferent between migrating according to the rules of the guest-worker program and not migrating at all. The slope of MN is negative because an increase in τ makes M more attractive in relation to N in the relevant range, requiring a lower w^* to keep $V^m = V^n$.[11] Anywhere above the MN locus, it pays to go abroad as a rule-abiding guest worker. Below the locus, workers prefer to stay permanently at home.

The two schedules divide Figure 1 into three regions of interest to us in the present study. In the region below the MN locus, the foreign wage and/or the legal duration of stay in H is not sufficient to induce migrants to go abraod and abide by the rules of the guest-worker program. For combinations of w^* and τ in the region to the left of MO and above MN, it pays to migrate as a guest worker, but then overstay and work in the host country without documentation. Finally, for combinations of w^* and τ in the region to

[11] Djajić (2010) shows that, depending on the parameters of the model, there may exist a large enough, critical value of $\tau = \bar{\tau}$, such that an increase in the duration of stay abroad above $\bar{\tau}$ makes a migrant worse off. Values of τ which are relevant for most guest-worker programs around the world, and hence the values we consider in the present study, are below $\bar{\tau}$.

the right of MO and above MN, it is optimal to migrate and strictly comply with the rules of the guest-worker program.

4 Incentives for Strict Compliance

We consider next the role of immigration policies, focussing on the extent to which they strengthen the incentives for strict compliance on the part of workers. Should the incentives prove to be insufficient, resulting in guest workers choosing to overstay, we examine the implications of each policy for x, the optimal duration of the overstay phase of a worker's planning horizon.

4.1 Role of Immigration Policies

Wage Penalty

Consider the impact of tightening internal enforcement aimed at employers of undocumented aliens. To the extent that such measures are effective, they will tend to manifest themselves in the form of an increase in the wage penalty, σ, facing undocumented workers. An increase in σ from 0.2 to 0.3 is shown to shift the MO schedule up and to the left in panel (a) of Figure 2. This signifies that if a migrant was initially indifferent between overstaying and voluntarily returning for a given combination of w^* and τ, he now prefers to return voluntarily. Since an increase in σ has no effect on the behavior of non-migrants and of documented guest workers who intend to return to S voluntarily at the end of their contract, the position of the MN schedule remans unchanged. In panel (b) on the right, we also observe a leftward shift of the X schedule, indicating that the optimal duration of the overstay is shorter with a larger σ for each value of w^* along the new MO locus. In sum, an increase in σ serves to (1) strengthen the incentives for strict compliance with the rules of the guest-worker program and (2) should a worker, nonetheless, decide to overstay, it reduces the optimal duration of the undocumented phase of his planning horizon.

Withholding Rate

Consider next the impact of a higher salary withholding rate. An increase in α from 0.10 to 0.15 percent of a contract worker's salary makes it less attractive to overstay, as the loss of wages for any given combination of w^* and τ is greater. This implies that the MO schedule shifts up and to the left, as illustrated in panel (a) of Figure 3. The MN locus remains unaffected because the withholding scheme affects only those who overstay. Should the now higher withholding rate still happen to be insufficient to induce strict compliance on the part of guest workers (i.e., for combinations of w^* and τ in the "Overstay" region above the MN schedule and to the left of MO in panel (a) of Figure 3), a higher withholding rate actually gives an incentive to those who overstay to do so for a *longer* period of time. This is shown by the rightward shift of the X locus in panel (b) on the right: An overstaying worker remains unambiguously longer in H, the larger the loss of withheld wages, other things being equal. This finding can be better understood by examining the optimality condition for the termination of the overstay phase, as stated in eq. (17). The withholding rate α does not have any *direct* effect on the cost *vs* benefit of staying an instant longer as an undocumented alien in the host country. It does, however, imply a lower stock of wealth for an overstaying worker and hence a higher value of λ^{os}. This increases the benefits relative to costs of overstaying an extra unit of time, resulting in a higher value of x for any given w^* along the MO schedule.[12]

Fine for Overstaying

An additional penalty for overstaying in the form of an exit fee operates in the same manner. It imposes an extra financial burden on an overstaying migrant, raises λ^{os}, and induces those who overstay to do so for a longer period of time. Still, an increase in ϕ provides a foreign contract worker with a stronger incentive for strict compliance with

[12]This finding has fundamentally the same basis as the discussion in Djajić (2001) on the relationship between the cost of illegal entry and the duration of an undocumented migrant's stay in the host country. See also Djajić and Milbourne (1988) on the relationship between migration costs and the optimal timing of return for temporary migrants.

the rules of the program. It shifts the MO schedule up and to the left, as in the case of an increase in the withholding rate, depicted in panel (a) of Figure 3.

These findings have very important implications for policy: 1) They establish that increases in the salary withholding rate or in the overstay penalty in the form of a monetary fine can deter guest workers from overstaying. In this sense they help address the problem of illegal immigration. 2) Should these measures fall short of being *sufficient* to induce strict compliance on the part of participants, they turn out to be counterproductive: They contribute to an expansion in the stock of undocumented aliens employed in the economy. In such cases of insufficiency, marginal increases in the levels of α and/or ϕ *do not* serve to reduce the flow of guest workers transiting to undocumented status, but they *do* increase the duration of the undocumented stay of those who don't comply. This effectively generates a larger equilibrium stock of undocumented workers. It follows that salary withholding schemes and overstay penalties must be carefully set in relation to the environment that guest workers face at home and abroad to be effective in *reducing* the stock of undocumented foreign workers.

Migration Costs

Let us examine next the implications of a reduction in the pecuniary cost of migration facing a guest worker, such as the cost of an entry visa, recruitment fees, or even in the tax imposed by H on the country's employers seeking authorization to hire guest workers. Such taxes are typically passed on to the workers in the form of a higher recruitment fee.

Panel (a) in Figure 4 shows that a reduction in K from 2 to 1-year's worth of source-country earnings makes migration more attractive relative to a permanent stay at home. It thus shifts the MN schedule down and to the left. It also enables a guest worker to attain larger holdings of accumulated assets during his documented stay in H, for any given values of w^* and τ. This makes overstaying less attractive, shifting the MO locus up and to the left. Note, in addition, that if K is lower, those who overstay do so for a shorter period of time, as shown by the leftward shift of the X locus in panel (b) of

Figure 4.

4.2 Role of The Economic Environment

Interest Rate and the Price Level

As we turn to the economic environment facing a migrant at home and abroad, we find that a higher rate of return, r, on investments at home and a larger cost-of-living differential between the host and the source country (i.e., a higher p^*), both serve to strengthen the incentives for strict compliance on the part of guest workers. This is shown by the leftward shift of the MO schedule in panel (a) of Figures 5, where r is raised from 6% to 8% and in Figure 6, where p^* is raised from 2 to 2.2. Moreover, a higher return on investments at home and a larger international price differential do not only make the incentives for strict compliance stronger, but they also call for a shorter optimal duration of an overstay, should the incentives for strict compliance prove to be insufficient: The X locus in panels (b) of Figures 5 and 6 shifts to the left.

This analysis confirms the findings of Schiff (2007) and Djajić (2013), that successful management of a guest-worker program hinges to a significant extent on the economic conditions in the countries of origin of program participants. A higher expected rate of return on repatriated assets and a higher foreign price level both serve to attract migrants back home. Selecting candidates for migration from countries characterized by a relatively high r and/or a larger price differential between the host and source countries can help reduce the number of guest workers who choose to overstay. The new finding here is that workers from such countries not only have greater incentives to comply with the rules of the program, but should they choose not to return home as scheduled, the optimal duration of their overstay phase is relatively shorter.

The Retirement Phase and Benefits

Introducing the retirement phase into the model serves to strengthen a worker's motive to migrate in order to accumulate assets for the purpose of supporting consumption

during retirement at home. The longer the retirement phase, the greater the need for accumulated savings as a worker's income is assumed to drop to a lower level after time T. This can be seen in panel (a) of Figure 7, where the MN schedule shifts down and to the left if we increase R from 10 to 20 years. The incentive to overstay is similarly stronger for the same reason, as reflected in a shift to the right of the MO locus in panel (a) and the X schedule in panel (b).

Retirement benefits at home, with their money value reflected in the flow b in our model, help offset the need for greater asset accumulation that made the incentives for migration and overstaying stronger with an increase in R. An increase in b therefore has the opposite effect (not shown) on the MN and MO schedules. Recruitment of guest workers from countries with more generous retirement benefits and other social programs that reduce the need for personal savings over the retirement phase, should therefore help host countries lower the number of guest workers who overstay and reduce the average duration of the overstay phase of those who don't comply with the rules of the program.

5 Conclusions

The main objective of this paper is to examine the role of immigration policies and of the economic environment facing foreign workers in determining whether participants in a guest-worker program choose to overstay or to return voluntarily to their countries of origin at the end of their contract period. For parameter values that reflect typical economic and policy environments that the guest-workers face in the host countries, an environment in which they would prefer to stay longer than allowed by the rules of the program, it is necessary for the authorities to provide an adequate incentive structure in order to achieve strict compliance. We consider in the present study the role of a salary withhold scheme, a fine for overstaying, and employer sanctions that reduce the market wage of undocumented aliens. Tougher employer sanctions are shown to lower the incentive to remain in the host country beyond the expiration of the work permit and to encourage those who overstay to return relatively sooner to their country of origin. A

higher salary withholding rate and a fine for overstaying also serve to discourage workers from overstaying. Should they nonetheless choose to stay in the host country beyond the expiration of the work permit, these policies actually induce the overstayers to remain in the host country for a *longer* period of time. This implies that increases in the salary withholding rate or in other forms of a pecuniary penalties that fall short of being sufficient to guarantee strict compliance with the rules of program are counterproductive with respect to the goal of reducing the stock of undocumented aliens in the economy. They fail to reduce the flow of guest workers transiting to undocumented status, yet increase the duration of the undocumented stay of those who do become illegal aliens. This effectively generates a larger equilibrium stock of undocumented workers. Thus the salary withholding rate and overstay penalty must be carefully designed in relation to the environment that guest workers face at home and abroad to be effective in *reducing* the stock of undocumented workers.

Lowering the cost of migration is found to make overstaying less attractive. Should some workers still choose to overstay, they will do so for a shorter period of time. Both a higher rate of return on investments at home and a larger cost-of-living differential between the host and the source country, help strengthen the incentives for strict compliance on the part of guest workers and shorten the optimal duration of an overstay, should the incentives for strict compliance prove to be insufficient. Retirement benefits at home also reduce the incentives for overstaying. Recruitment of guest workers from countries that offer their citizens more generous retirement benefits, that have relatively low price levels, and where returnees can enjoy high yields on repatriated savings, can help host countries lower the number of guest workers who overstay and reduce the optimal duration of the overstay phase for those who fail to comply with the rules of the program.

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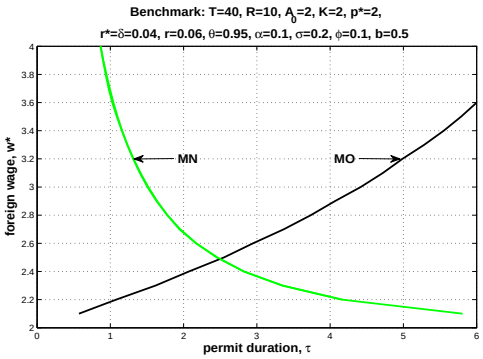

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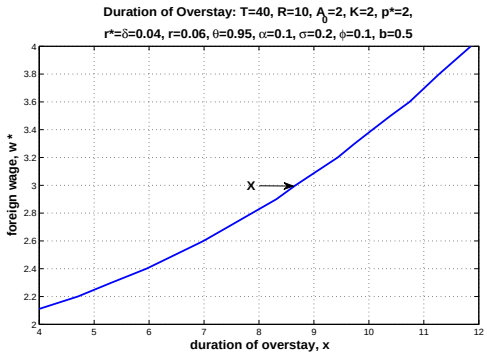
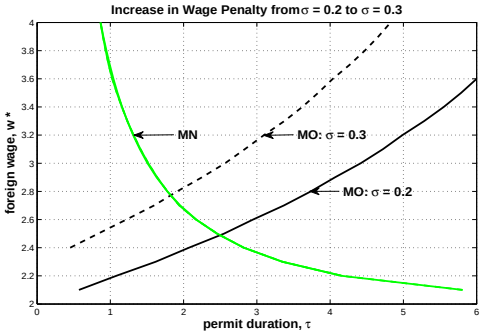


(b) Overstay

Figure 1: The choice of migration options and the optimal duration of overstay



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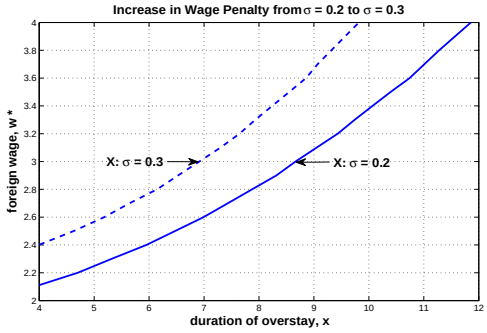
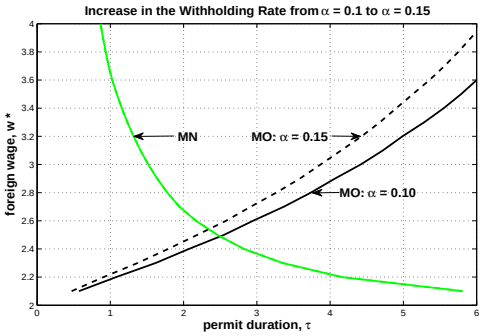


(b) Overstay

Figure 2: Effects of stricter internal enforcement measures



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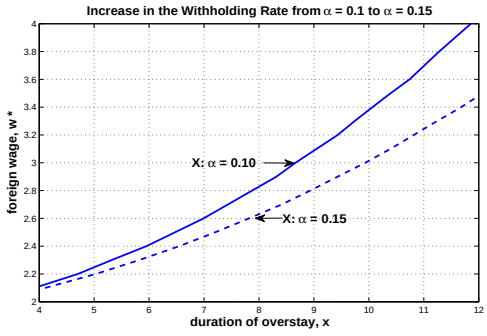
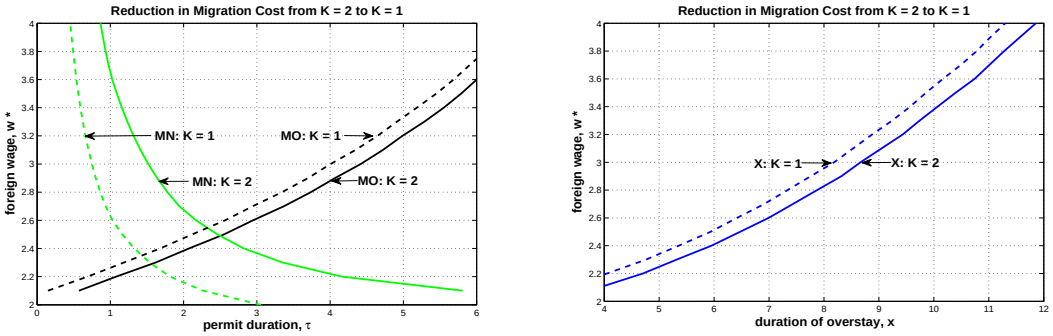


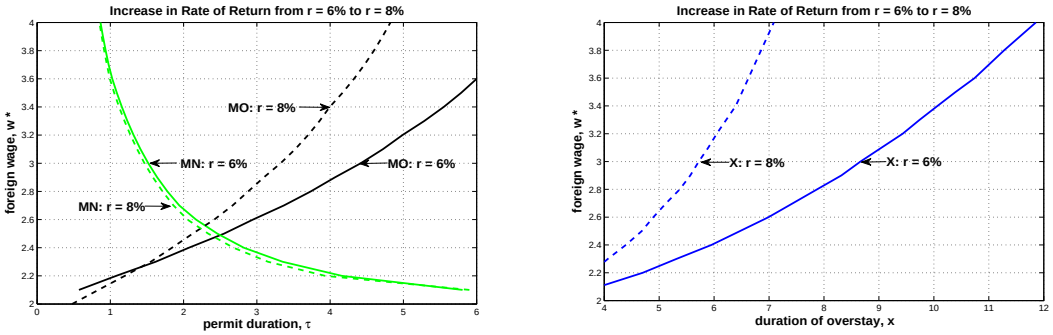
(b) Overstay

Figure 3: Effects of an increase in the withholding rate



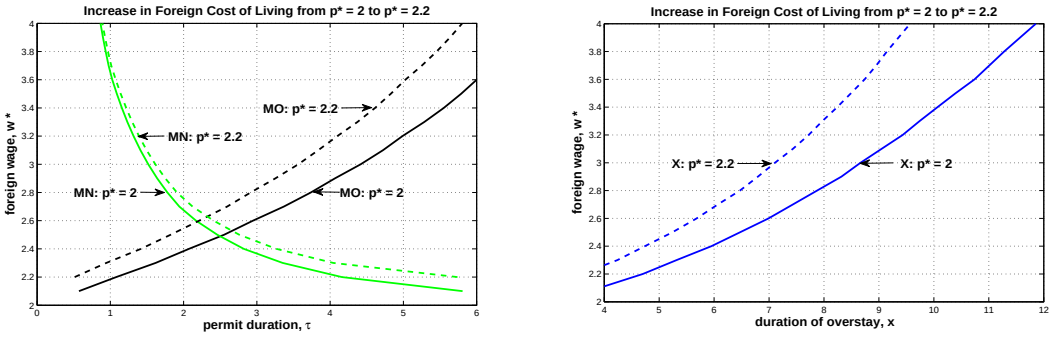
(a) Options (b) Overstay

Figure 4: Implications of a reduction in migration costs



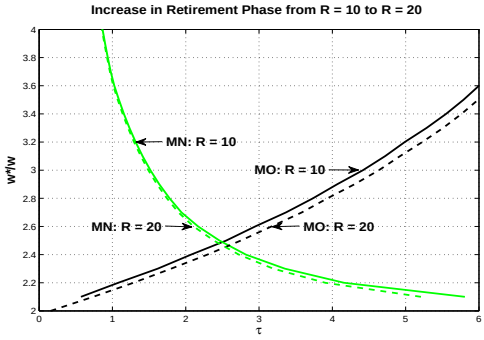
(a) Options (b) Overstay

Figure 5: Implications of a higher rate of return on repatriated savings

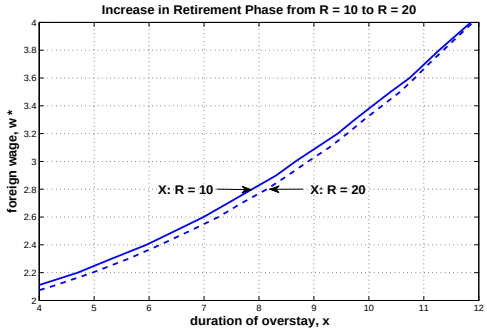


(a) Options (b) Overstay

Figure 6: Implications of a higher price level in the host country



(a) Options



(b) Overstay

Figure 7: Longer retirement phase