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Illegal Migration, Enforcement and Minimum Wage

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Non-Technical Abstract

This paper examines the connection between illegal migration, minimum wages and enforcement policy. We first explore the employers' decision regarding the employment of illegal migrants in the presence of an effective minimum wage. We show that the employers' decision depends on the wage gap between those of the legal and illegal workers and on the penalty for employing illegal workers. We consider the effects a change in the minimum wage has on the employment of illegal immigrants and local workers. We conclude by considering the optimal migration policy taking into consideration social welfare issues.

Keywords: illegal immigration, migration policy, minimum wage, interest groups.

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Abstract

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1. Introduction

Illegal immigration is a very hot social and economic issue facing many technologically advanced countries. Despite efforts to limit the number of immigrants allowed into these countries, the illegal immigrant stock is rising. It is difficult to accurately estimate the number of illegal immigrants. At the beginning of 2000, some OECD countries published official figures of unauthorized immigrants.[2] In the USA, estimates were between 4 to 7 million,[3] which is about 1.5% of the population. In Greece it was about 3% and in Italy about 0.5%. The increasing stock of illegal immigrants has turned it into a central issue in numerous elections throughout the Western Hemisphere.

The effect of legal immigration on the host country's welfare is controversial. Some studies found that the immigrants are a benefit to the local population and others claimed the opposite (see, for example, Berry and Soligo, 1969; Rivera-Batiz, 1982 and Borjas, 1995). However, it is widely believed that illegal immigration is detrimental to the host country. This is because the illegal immigrants impose additional costs by the essence of their illegality, in addition to the burden imposed by their illegality, i.e. the replacement of local workers. The illegal immigrants tend not to pay taxes and are often involved in clandestine activities both as felons and as victims. Furthermore, their existence serves as a signal to the natives that the government does not enforce the law or that illegality is acceptable, thus causing them to avoid paying taxes (see Epstein and Weiss, 2006).

Many articles discuss the government's efforts to control illegal immigration (for example, Ethier, 1986; Chiswick, 1988; Zimmermann, 1995; Djajic, 1999; Gaytan-Fregoso and Lahiri, 2000 and more recently Guzman et al., 2007). Efforts to reduce illegal immigration utilize a number of instruments. The main instrument is the allocation of resources for apprehending illegal immigrants. This is implemented via border controls which block the entry of undesirable elements as well as internal enforcement, whereby such people are apprehended and expelled from the country. Some countries also provide foreign aid to the country of origin in order to reduce income differentials and thus the incentive to immigrate. An additional way to minimize

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[2]See http://www.oecdobserver.org/news/fullstory.php/aid/190
[3] See http://www.cis.org/topics/illegalimmigration.html

illegal immigration, which has recently become very common, is to grant amnesties to illegal immigrants who have been in the country for an extended period of time.

The Immigration Reform and Control Act (IRCA) of 1986 in the U.S.A. represents an attempt to control illegal immigration by imposing fines on employers who hire unauthorized workers (see for example Cobb-Clark et al., 1995). Employers who knowingly hire illegal alien workers are subject to civil money penalties of \$250 to \$2,000 per worker for a first offense and \$3,000 to \$10,000 per alien for a third offense[4]. Western Europe countries, such France and Germany, also enacted employer sanctions in the mid-1970s. In France Employers are liable for penalties of up to 1000 times minimum wage, while in Germany the maximum fine is 52,600\$. In UK employer sanctions exist since 1997 and the maximum fine is 8,000\$ per illegal worker hired (Martin and Miller, 2000)

A vast literature exists on migration policy (see for example, Benhabib, 1996, Bauer et al, 2000), but only few articles examine the interaction between economic and political processes. Amegashie (2004) studied a model in which the number of immigrants allowed into a country is the outcome of a costly political lobbying process between a firm and a union, using the all-pay auction contest. Epstein and Nitzan (2006) have recently presented a model for the endogenous determination of quotas, viewing the quota as the outcome of a two-stage political contest between two interest groups, i.e. workers and capital owners. Garcia (2006) explained why the control of immigration may be a relevant issue in elections and demonstrated that rightist parties have an advantage of winning in countries where immigration control is a relevant issue in the election. Grether et al. (2001) determined the migration policy as result of the electorate's preferences. Epstein and Hillman (2003) presented migration policy implications of the efficiency wage setting.

Although many studies deal with the issue of illegal immigration, as mentioned above, there are almost no references to the employers' decision regarding the number of legal and illegal workers. The majority of these studies simply assume that when the expected penalty faced by the employer increases, the number of illegal immigrants

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[4] In some countries sanctions are less effective at deterring illegal entry and employment for several reasons, including among others, allocation of few resources, the spread of false documents and insufficient cooperation between government agencies.

decreases (see for example Epstein, Hillman and Weiss, 1999). In our study we consider the relationship between the number of illegal immigrants and the employer's benefits (wage gap between legal and illegal workers) and costs of employing them (expected penalty). We also examine how a change in the minimum wage affects the illegal immigrants and the local workers.

Another purpose of this study is to examine the optimal migration policy. The low wage requested by foreign workers encourages capital owners to employ them. The policy maker may protect the unskilled workers by establishing a minimum wage law and allocating resources to catch the non-complying employers (i.e. employers who employ illegal workers). In our model two interest groups are directly affected by the migration policy: the capital owners who benefit from illegal immigrants and the unskilled workers who suffer from them. The public is affected indirectly by illegal immigration. The politician determines the optimal policy by taking into account all the factors: the capital owners' and the unskilled workers' utility, the public interest and the financing cost.

This paper is organized as follows. The following section presents the decision faced by the illegal workers and the employers. Section 3 determines the optimal enforcement budget. The last section contains a brief summary and conclusion.

2. The Employers' and the Workers' Decisions

The employer's decision:

Consider a small open and competitive economy where the employers are risk neutral and may employ local unskilled workers or foreign workers in return for a wage that is lower than the equilibrium wage of a closed economy. In order to protect these workers, the government establishes a *minimum wage*, w_M, for all workers. Moreover *immigration law* forbids employing foreign workers who lack employment authorization.

The employer's profits equal:

(1) $$\Pi_E = VF(N) - Nw_M,$$

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Where N is the number of unskilled workers, $F(N)$ is the production function, which satisfies $F'(N) > 0, F''(N) < 0$, and V is the product price. Denote the optimal number of unskilled workers by N^*, which satisfies:

(2) $$VF'(N) = w_M,$$

Now we assume the following:

1. The employer may employ illegal workers, I, who are perfect substitutes for the legal unskilled workers.

2. The wage for a foreign illegal worker, w_I, is lower than the wage of a legal workers, w_M (below we will determine the foreign illegal worker's wage, w_I).

3. The employer pays wages which are lower than the minimum wage only to the illegal immigrants. The reason for this is that the illegal foreign workers are afraid to complain about their employers paying them a low wage. When an illegal worker is apprehended, both the worker and the employer are affected: the illegal worker is expelled from the country and sanctions against the employer are implemented. In addition, as seen below, the wage requested by foreign workers may be lower significantly from the wage requested by local worker. Therefore the "illegal workers" are herewith called "illegal immigrants".

4. An employer who employs illegal immigrants may be detected and punished with probability p.

5. The policy maker can regulate, p, by an enforcement budget, E, i.e. $p(E)$ such that $p'(E) > 0, p''(E) < 0$.

6. The penalty for employing illegal workers depends on the number of illegal immigrants, $\theta(I)$, such that $\theta(0) = 0$ and $\theta'(I) > 0, \theta''(I) > 0$.[5] Moreover, we assume that $\theta'''(0) = 0$. This assumption simplifies our calculations. Below we show where this assumption is used and that it is not critical for our results.

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[5] Indeed, in a lot of countries, the fine is constant for each employee, but when marginal production decreases then the apprehension of a worker increases the costs to the employer in a non-linear way. In addition, the financial cost of the fine (for instance, the marginal interest) increases as the total fines increases.

7. At the beginning of each period, the employer decides on the number of legal and illegal workers to employ.

The employer's expected profit is given by:

(3)
$$E\left(\Pi_E\right) = VF(N) - Lw_M - Iw_I - p\theta(I)$$

s.t.

(3')
$$N = L + I,$$

The employer determines the optimal number of workers and illegal immigrants. Therefore, the first-order-conditions for maximizing the profits are[6]:

(4)
$$\frac{\partial E\left(\Pi_E\right)}{\partial N} = VF'(N) - w_M = 0$$

and

(5)
$$\frac{\partial E\left(\Pi_E\right)}{\partial I} = w_M - w_I - p\theta'(I) = 0,$$

We obtain that the wages will equal:

(6.1)
$$w_M = w_I + p\theta'(I)$$

and

(6.2)
$$VF'(N) = w_I + p\theta'(I),$$

At equilibrium, the marginal cost of employing an illegal immigrant equals the wage of a legal worker - the minimum wage, w_M. The employer employs illegal immigrants as long as the cost for employing them, $w_I + p\theta'(I)$, is lower or equal to the minimum wage. Afterwards, he continues to employ legal workers as long as their wage, w_M, is lower or equal to the marginal value of production, $VF'(N)$. This result is supported by Yaniv's (2001) conclusions that the employer reduces employment to the

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[6] The second-order conditions for maximum are satisfied.

point where the marginal value of the production equals the minimum wage but the total number of workers doesn't change as a result of violating the migration law.

Lemma 1: *A positive relationship exists between the stock of employed illegal immigrants and the level of minimum wage.*

Proof: Using the inverse function rule with equation (6.1) we obtain:

$$(7) \qquad \frac{\partial I}{\partial w_M} = \frac{1}{\dfrac{dw_M}{dI}} = \frac{1}{p\theta''(I)},$$

As assumed above, $\theta''(I) > 0$, hence $\dfrac{\partial I}{\partial w_M} > 0$. !

The illegal immigrants' decision:

It is assumed that the wage in the destination country is higher than the wage in the source country. However, the immigrant has an adjustment cost that stems from living in an unfamiliar environment (see, for example, Chiswick, 1999). In addition to this cost, the illegal immigrant is subject to apprehension and deportation by the authorities. If he is apprehended, he has additional the costs of lost wages and distress.

The potential immigrant will therefore agree to immigrate illegally if the wage received in the destination country, w_I, is higher than the wage in the source country, w_H, including the penalty if he is apprehended, λp, and the adjustment cost in the host country, c. The condition for illegal immigration can be written as follows:

$$(8) \qquad w_I \geq w_H + c + p\lambda,$$

Note that this condition is written for one period.[7]

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[7] For simplicity, we ignore the one-time moving cost. But it can be assumed that this cost is divided over all the periods.

The employer pays the illegal immigrants the minimal wage that they are willing to accept. Setting equation (8) into (5) gives:

$$(9) \qquad p(E) = \frac{w_M - w_H - c}{\lambda + \theta'(I)}$$

Equation (9) determines the conditions for the optimal number of illegal immigrants, I_e, that are employed for a given enforcement budget, E. Let us explain this equality by looking at figure 1 that represents equation (9): the solid line represents the number of employed workers, N_e, whereas the dashed line represents the number of legal workers (local and foreign), L_e. The gap between these lines represents the number of illegal workers, I_e. At point (a) the government does not allocate resources against illegal immigration (i.e., $p(E) = 0$), the employers employ only illegal immigrants and their number is higher than N^*, the number of workers whose marginal product value equals the minimum wage (see equation (2)). In area (b) the probability of being detected increases and the number of illegal immigrants decreases. However, the employer continues to employ only illegal immigrants and their number is higher than N^*. In area (c) the employer employs both legal and illegal workers such that the cost of employing illegal workers equals the cost of employing legal workers, i.e. the minimum wage. The number of all the workers equals N^*. In area (d) the probability of being detected is so great that the employer complies with the law and employs only legal workers. To summarize,

Proposition 1 *(see figure 1):*

(a) If $p = 0$ then $N_e = I_e = N$ and $L_e = 0$. Therefore, N_e satisfies:

$$(10) \qquad VF'(N_e) = w_H + c.$$

(b) If $p \in (0, \dfrac{w_M - w_H - c}{\lambda + \theta'(N^*)})$ then $N_e = I_e > N^*$ and $L_e = 0$. Therefore, I_e satisfies:

(11) $$VF'(I_e) = w_H + c + p\lambda + p\theta'(I_e).$$

(c) If $p \in (\dfrac{w_M - w_H - c}{\lambda + \theta'(N^*)}, \dfrac{w_M - w_H - c}{\lambda + \theta'(0)})$ *then* $N_e = N^*$, $I_e \in (N^*, 0)$ *and* $L_e \in (0, N^*)$.

Therefore, I_e *satisfies:*

(12) $$w_M = w_H + c + p\lambda + p\theta'(I_e).$$

(d) If $p > \dfrac{w_M - w_H - c}{\lambda + \theta'(0)}$ *then* $N_e = L_e = N^*$ *and* $I_e = 0$. *Therefore,* L_e *satisfies:*

(13) $$VF'(L_e) = w_M.$$

Proof:

(a) From setting $p = 0$ in equations (8) and (6.1), we obtain $w_I = w_H + c$ and $w_M > w_I$ (w_M is constant), respectively. This means that the cost of employing an illegal immigrant is lower than in the case of $p > 0$ and than the wage for a legal worker. The employer therefore employs only illegal workers. From equation (6.2) we obtain that the number of employed workers holds $VF'(N_e) = w_H + c = w_I$.

(b) From equations (8) and (6.1) it follows that the cost of employing an illegal immigrant is higher than the cost of case (a), but is still lower than the wage for a legal worker. The employer thus continues to employ only illegal workers. From equation (6.2) together with (8), we obtain that the number of employed illegal workers holds $VF'(I_e) = w_H + c + p\lambda + p\theta'(I_e)$.

(c) From equations (6.1), (6.2) and (8) it follows that $VF'(N_e) = w_M = w_I + p\theta'(I_e)$ such that $w_I = w_H + c + p\lambda$. This means that the cost of employing illegal immigrants equals the wage for legal workers and equals the marginal product.

(d) From equation (6.1) it follows that the cost of employing legal workers is higher than the wage for legal immigrants, i.e. $w_M < w_I + p\theta'(I)$. The employer

therefore employs only legal workers and their number holds $VF'(L_e) = w_M$.

!

Let us now focus on the case of area (c) under which both illegal and legal workers are employed. In this case, the total number of workers is identical to the number of workers that would be employed if only legal workers are employed (d).

3. Optimal Policy

Let us firstly examine how a change in the minimum wage affects the number of *local* workers employed. The legally employed workers consist of the legal native workers, L_L, and the foreign workers, L_F. We assume that the employers first employ the local workers, and if there is a surplus demand for legal workers then they import foreign workers. The number of local workers is given by:

(14) $$L_L = N - L_F - I.$$

Figure 2 describes the effect of increasing the minimum wage to $w_M^1 > w_M$ on the optimal number of workers, N^*. From equation (2) and from the sign of the second derivative of $F(N)$ (i.e., $F''(N) < 0$), it follows that $\dfrac{dN}{dw_M} < 0$. Thus the optimal number of workers thus decreases from N^* to N^{**}.

It is also easy to see that the boundaries described above, $\dfrac{w_M - w_H - c}{\lambda + \theta'(N^*)}$ and $\dfrac{w_M - w_H - c}{\lambda + \theta'(0)}$, move to the right to $\dfrac{w_M^1 - w_H - c}{\lambda + \theta'(N^*)}$ and $\dfrac{w_M^1 - w_H - c}{\lambda + \theta'(0)}$, respectively. Hence, area (b) – the area of employing only illegal workers – expands and area (d) – the area of employing only legal workers – diminishes. This is supported by lemma 1, which stated that $\dfrac{dI}{dw_M} > 0$. This means that if the government wants to prevent the rise in the stock of illegal immigrants resulting from the increase in the minimum wage, it must allocate more resources to counteract illegal immigration (moving to the right in figure

2). An additional effect of the rise in the minimum wage is described as follows: the supply of local workers who wish to work for the current wage increases and the number of legal foreigners decreases, i.e. $\dfrac{dL_F}{dw_M} < 0$ (The illegal immigrants and the local workers replace them).

A change in the minimum wage affects the number of legal workers and equals:

(15)
$$\frac{dL}{dw_M} = \frac{dN}{dw_M} - \frac{dI}{dw_M},$$

Proposition 2*:*

    a. *Raising the minimum wage decreases the number of **legal workers** employed if the wage is lower than the equilibrium wage of a closed economy. The change in the number of legal workers is greater than the change in the number of all workers.*

    b. *Raising the minimum wage has an ambiguous effect on the number of **local legal workers** employed.*

Proof:

    a. $\dfrac{dL}{dw_M} = \dfrac{dN}{dw_M} - \dfrac{dI}{dw_M} < 0$, the LHS, the change in the number of legal workers,

equals the change in the number of all workers plus the negative term $\left(-\dfrac{dI}{dw_M} \right)$

    b. When the minimum wage increases the supply of local workers increases and they replace the legal foreign workers. However, the total number of workers diminishes and the number of illegal workers rises. If the former effect is bigger than the latter, then the number of local workers increases, and *vice versa* if the former effect is smaller than the latter. $\dfrac{dL_L}{dw_M} = \dfrac{dN}{dw_M} - \dfrac{dI}{dw_M} - \dfrac{dL_F}{dw_M}$, the two first

terms of RHS are negative and the last term is positive. Therefore, it is impossible to know the sign of $\dfrac{dL_L}{dw_M}$.   !

It should be noted that recent studies have indeed found zero or even a positive effect of minimum wage on employment in monopsony markets (Dickens et al., 1999). However, other studies show that raising the minimum wage has a negative effect on employment (see Yaniv, 2001). Our model differs from the existing type of models in the literature.

3.1 The optimal enforcement budget

In our model the politician determines the optimal enforcement budget. We assume that the politician wishes to maximize social welfare, including the costs and benefits of the unskilled workers, the capital owners and the economic as well as social costs as a result of illegal immigration. It should be noted that if the politician determines the optimal minimum wage and the struggle between the unskilled workers and the capital owners is over the minimum wage rather than over the enforcement level, our main results will not change.[8]

When the enforcement budget increases, the capital owners reduce the number of illegal immigrants for two reasons: 1. the probability of being detected and the expected penalty increase. 2. The wage requested by the illegal immigrants also increases (see equation (8)). Hence, increasing the enforcement budget causes a decrease in the capital owners' profits. The main costs of the existence of illegal immigration are displacement of the local unskilled workers and a reduction in received wages. It is thus clear that increasing the enforcement budget decreases the number of immigrants staying in the host country, the unemployment of local unskilled workers decreases and their utility increases.

The secondary costs are caused by the essence of their illegality. For example, the undocumented immigrants are often involved in clandestine activities and are used

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[8]Since $\dfrac{\partial^2 G}{\partial E \partial w_M} = \dfrac{\partial^2 G}{\partial w_M \partial E}$, where G is the politician's objective function, E is the enforcement budget and w_M is the minimum wage.

as signals to the public that the government does not enforce the law. Raising the resource allocation to enforce the immigration law, i.e. the enforcement budget, reduces the social cost, but it has a price – the alternative use. This means that these resources are allocated non-productive activities.

The unskilled workers are interested in raising the enforcement budget, while the capital owners are interested in reducing it.

The government's objective function is represented by:[9]

(16) $\qquad G = \alpha \Pi_L + (1-\alpha)\Pi_E - \beta C(I) - \gamma E$,

Where E is the enforcement budget, α is the workers' relative political strength $(0 < \alpha < 1)$, Π_L is the local workers' earning[10], Π_E is the profits of the capital owners as given in equation (3), C is the social harm resulting from the existence of illegal immigrants, such that $C(0) = 0, C'(I) > 0, C''(I) < 0$, β and γ denote the weights of this social harm and the enforcement budget $(0 < \beta, \gamma < 1)$, respectively. Equation (16) can be rewritten as:

(17) $\qquad G = \alpha L_L w_M + (1-\alpha)(VF(N) - w_M(N-I) - Iw_I - p\theta(I)) - \beta C(I) - \gamma E$.

The optimal enforcement budget equals:

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[9] Another scenario is that the enforcement budget is financed by the fines and taxes. The public bears the tax burden paying for the enforcement (like Guzman et al., 2007) and takes part in the struggle. Hence the government's objective function will be

$$G = \alpha \Pi_L + \beta \Pi_E - (1-\alpha-\beta)U_{public}$$

$$s.t. \quad U_{public} = -(C(I) + t(E))$$

$$E = p\theta(I) + t \quad \forall \quad t \geq 0$$

Where t is the tax, the other variables are similar to the paper's body. The core of the results does not change and will be provided on request.

[10] We use the workers' wages, and not the workers' surplus, because the declared main goal of the minimum wage is to maximize the total income transfer to minimum wage workers (Sobel, 1999). Furthermore, the labor supply curve is unknown (except for the fact that it increases) and when the workers' total wages increase - the "workers' surplus" also increases.

$$(18) \quad \frac{dG}{dE} = \alpha \frac{\partial L_L}{\partial E} w_M + (1-\alpha)\left(\frac{\partial I}{\partial E} w_M - \frac{\partial I}{\partial E} w_I - I \frac{\partial w_I}{\partial E} - \frac{\partial p}{\partial E} \theta(I) - p\theta'(I)\frac{\partial I}{\partial E} \right)$$
$$-\beta C'(I)\frac{\partial I}{\partial E} - \gamma = 0$$

The regulator faces a given employers' and illegal immigrants' behavior, as discussed above. The difference between the minimum wage and the illegal workers' wage at equilibrium equals the expected penalty (see equation (6.1)):

$$(19) \quad p\theta'(I) = w_M - w_I,$$

In addition, from equation (8) it follows that:

$$(20) \quad \frac{\partial w_I}{\partial E} = \lambda \frac{\partial p}{\partial E},$$

From setting equation (19) and (20) into (18), we obtain:

$$(21) \quad \frac{dG}{dE} = \alpha \frac{\partial L_L}{\partial E} w_M + (1-\alpha)\left(\frac{\partial I}{\partial E} w_M - \frac{\partial I}{\partial E} w_I - \frac{\partial p}{\partial E}\left(I\lambda + \theta(I)\right) - \left(w_M - w_I\right)\frac{\partial I}{\partial E} \right),$$
$$-\beta C'(I)\frac{\partial I}{\partial E} - \gamma = 0$$

Rearranging equation (21) gives us:

$$(22) \quad \frac{dG}{dE} = \alpha \frac{\partial L_L}{\partial E} w_M - (1-\alpha)\frac{\partial p}{\partial E}\left(I\lambda + \theta(I)\right) - \beta C'(I)\frac{\partial I}{\partial E} - \gamma = 0,$$

Hence, the optimal enforcement is given by[11]:

$$(23) \quad \alpha \frac{\partial L_L}{\partial E} w_M - \beta C'(I)\frac{\partial I}{\partial E} = \gamma + (1-\alpha)\frac{\partial P}{\partial E}\left(I\lambda + \theta(I)\right),$$

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[11] It is assumed that the sufficient second order conditions are satisfied.

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If there are local workers willing to work at the minimum wage, then $\frac{\partial L_L}{\partial E} > 0$.

Moreover we know that $\frac{\partial I}{\partial E} < 0, \frac{\partial P}{\partial E} > 0, C'(I) > 0$.

3.2 Comparative static

Suppose that an exogenous change in the minimum wage has taken place.[12] Let us now examine how this change affects the optimal enforcement budget.

As shown above, raising the minimum wage decreases the number of employed workers and increases the number of illegal immigrants working in the host country. We also see that the effect, of raising the minimum wage for the local workers' employment, is not clear. The unskilled workers and the capital owners are affected by the migration policy and struggle in order to change the enforcement budget. Indeed, the capital owners suffer from the additional cost of illegal immigration and finance the enforcement. However, their direct benefit from illegal immigration is higher. We can therefore say that the unskilled workers have an interest in a large enforcement budget, while the capital owners have the opposite interest.

Denote the optimal enforcement budget (which satisfies (23)) by E^*. Let us now examine how an exogenous change in the minimum wage affects E^*. To simplify we ignore $\frac{\partial^2 C}{\partial w_M \partial E}$.[13] It can be verified that:

$$(24) \qquad \frac{\partial E^*}{\partial w_M} = - \frac{\dfrac{\partial^2 G(.)}{\partial E \partial w_M}}{\dfrac{\partial^2 G(.)}{\partial E^2}},$$

By the second order condition, $\frac{\partial^2 G(.)}{\partial E^2}$ is assumed to be negative, so:

(25)
$$sign\left\{\frac{\partial E^*}{\partial w_M}\right\} = sign\left\{\frac{\partial^2 G(.)}{\partial E \partial w_M}\right\},$$

It is known that $L_L = L_L(w_M)$ and $I = I(w_M)$, hence $\dfrac{\partial\left(\dfrac{\partial L_L}{\partial E} w_M\right)}{\partial w_M} = \dfrac{\partial L_L}{\partial E} + \dfrac{\partial^2 L_L}{\partial E \partial w_M} w_M$

and $\dfrac{\partial\left(I\lambda + \theta(I)\right)}{\partial w_M} = \lambda\dfrac{\partial I}{\partial w_M} + \theta'(I)\dfrac{\partial I}{\partial w_M}$. Hence, from equation (22) we obtain:

(26)
$$\frac{\partial^2 G(.)}{\partial E \partial w_M} = \alpha\left(\frac{\partial L_L}{\partial E} + \frac{\partial^2 L_L}{\partial E \partial w_M} w_M\right) - (1-\alpha)\frac{\partial p}{\partial E}\left(\lambda\frac{\partial I}{\partial w_M} + \theta'(I)\frac{\partial I}{\partial w_M}\right),$$

From equation (9) and the quotient rule, we obtain:

(27)
$$\frac{\partial p}{\partial E} = -\frac{(w_M - w_H - c)\theta''(I)}{(\lambda + \theta'(I))^2}\frac{\partial I}{\partial E},$$

Setting equation (27) into (26) gives:

(28)
$$\frac{\partial^2 G(.)}{\partial E \partial w_M} = \alpha\left(\frac{\partial L_L}{\partial E} + \frac{\partial^2 L_L}{\partial E \partial w_M} w_M\right) + (1-\alpha)\frac{(w_M - w_H - c)\theta''(I)}{(\lambda + \theta'(I))^2}\frac{\partial I}{\partial E}\left(\lambda\frac{\partial I}{\partial w_M} + \theta'(I)\frac{\partial I}{\partial w_M}\right)$$

Equation (28) can be written as:

(29)
$$\frac{\partial^2 G(.)}{\partial E \partial w_M} = \alpha\left(\frac{\partial L_L}{\partial E} + \frac{\partial^2 L_L}{\partial E \partial w_M} w_M\right) + (1-\alpha)\frac{(w_M - w_H - c)\theta''(I)}{\lambda + \theta'(I)}\frac{\partial I}{\partial E}\frac{\partial I}{\partial w_M},$$

Setting equation (9) into (29) affords:

(30)
$$\frac{\partial^2 G(.)}{\partial E \partial w_M} = \alpha \left(\frac{\partial L_L}{\partial E} + \frac{\partial^2 L_L}{\partial E \partial w_M} w_M \right) + (1-\alpha) p \theta''(I) \frac{\partial I}{\partial E} \frac{\partial I}{\partial w_M},$$

After setting equation (7) into (30), we obtain:

(31)
$$\frac{\partial^2 G(.)}{\partial E \partial w_M} = \alpha \left(\frac{\partial^2 L_L}{\partial w_M \partial E} w_M + \frac{\partial L_L}{\partial E} \right) + (1-\alpha) \frac{\partial I}{\partial E},$$

Hence, by equation (24) and (31) it follows that:

(32)
$$sign\left\{ \frac{\partial E^*}{\partial w_M} \right\} = sign\left\{ \alpha \left(\frac{\partial^2 L_L}{\partial w_M \partial E} w_M + \frac{\partial L_L}{\partial E} \right) + (1-\alpha) \frac{\partial I}{\partial E} \right\},$$

The first term in RHS denotes the effect of a change in the enforcement budget on the unskilled workers' wages, whereas the second term denotes the effect of a change in the enforcement budget on the capital owners' profits. It is obvious that there is a negative relationship between the enforcement budget and the capital owners' profits (i.e. $\frac{\partial I}{\partial E} < 0$). However, the effect of a change in the enforcement budget on the unskilled workers' wages is ambiguous.

In order to calculate the sign of $\frac{\partial E^*}{\partial w_M}$, we distinguish between two cases:

A) Local workers are willing to work at the minimum wage

As we see in figure 3.1 the employer employs local workers but does not need to employ legal foreign workers, i.e. $L_F = 0$. If the government raises the enforcement budget, the stock of illegal immigrants decreases and the number of local workers increases, i.e. $\frac{\partial L_L}{\partial E} > 0, \frac{\partial^2 L_L}{\partial w_M \partial E} > 0$ (See appendix A). The first component of RHS in equation (32) is therefore positive and the second is negative.

Proposition 3: *The effect of changes in the minimum wage on the optimal enforcement budget depends on the political strength of the groups. If the workers' weight, α, is*

higher than $\dfrac{\dfrac{\partial L_L}{\partial E}}{2\dfrac{\partial L_L}{\partial E} + \dfrac{\partial^2 L_L}{\partial E \partial w_M} w_M} < \dfrac{1}{2}$, *then a positive relation exists between the optimal*

enforcement budget and the minimum wage. Whereas if $\alpha < \dfrac{\dfrac{\partial L_L}{\partial E}}{2\dfrac{\partial L_L}{\partial E} + \dfrac{\partial^2 L_L}{\partial E \partial w_M} w_M}$, *then a*

negative relation exists between the optimal enforcement budget and the minimum wage.

Proof: See appendix B.

The intuition for this result is as follows: as stated in lemma 1, raising the minimum wage causes an increase in the illegal immigrants employed in the host country. It is also clear that as the total number of workers and the total production decreases, the expected penalty increases and the capital owners' profits decrease (see appendix C). This is followed by an increase in the number of employed illegal immigrants, the unemployment among the local workers increases and therefore the utility of the local workers decreases.

If the workers have a high political strength relative to the capital owners' then the policy maker raises the resource allocation against illegal migration with an increase in the minimum wage. The reason for this is that increasing the budget enforcement prevents an increase in the stock of illegal immigrants and possible harm to the local workers' utility. However, if the capital owners have strong political strength, the policy maker reduces the enforcement budget with an increase in the minimum wage since increasing the minimum wage decreases the capital owners' profits. The politician wishes to raise, or at least maintain, the utility of the strong group, and achieves this by reducing the enforcement budget.

B) No local workers are willing to work at the minimum wage

Look at figure 3.2. In this case the demand for legal workers is higher than the local supply. Thus, the employer should employ legal foreign workers, i.e. $L_F > 0$. Raising the enforcement budget reduces the stock of illegal workers, increases the number of legal foreign workers, but does not affect the number of employed local workers, i.e.

$\frac{\partial L_L}{\partial E} = 0$ and $\frac{\partial^2 L_L}{\partial w_M \partial E} = 0$ (in this zone, the change in the minimum wage has no affect

$\frac{\partial L_L}{\partial E} = 0$). Setting $\frac{\partial L_L}{\partial E} = 0, \frac{\partial^2 L_L}{\partial w_M \partial E} = 0$ into equation (32), gives:

$$(33) \quad sign\left\{\frac{dE^*}{dw_m}\right\} = sign\left\{(1-\alpha)\frac{\partial I}{\partial E}\right\} < 0.$$

Thus,

Proposition 4: *When the minimum wage increases and there are no local workers willing to work for this wage, the policy maker decreases the enforcement budget.*

In this case, as a result of increasing the minimum wage the utility of one group, the capital owners, decreases while the utility of the other group, the local workers, does not change (the illegal immigrants displace the legal foreign workers but not the legal local workers). The politician may increase the capital owners' profits without harming the local workers' utility. The politician therefore reduces the enforcement budget as long as there is no harm in the local workers' employment. After that he behaves as described in case (A).

Let us examine how a change in the strength of one of the parties affects the optimal enforcement budget. In a way similar to (32) we obtain:

$$(34) \quad sign\left\{\frac{dE^*}{d\alpha}\right\} = sign\left\{\frac{\partial L_L}{\partial E} w_M + \frac{\partial P}{\partial E}(I\lambda + \theta(I))\right\} > 0.$$

It is clear that increasing the workers' relative political strength raises the enforcement budget and *vice versa* if the capital owners' relative political strength increases. It is interesting to note that if $\frac{\partial L_L}{\partial E} = 0$, then the local workers have no incentive to try to increase their relative political strength.

4. Conclusion

We examined two policy measures designed to protect the unskilled workers and the public: preventing a decrease in wage by a minimum wage law and allocating resources to enforce the immigration law. We have focused on the employers' behavior and on the consequent migration policy. As opposed to studies assuming a negative relationship between the enforcement budget and the stock of illegal workers, we find the relationship between the number of employed illegal immigrants and the enforcement budget: at low budget levels employers employ only illegal workers and their number is higher than the total number of workers at higher budget levels. At high budget levels the employer complies with the immigration law and employs only legal workers.

In our story we consider a small open economy. The employer may employ legal workers and either pay them minimum wage or not. However, the employer prefers to discriminate against the foreign workers by paying them a lower wage than the local workers, because they are in the country illegally and may be afraid to complain to the authorities. Thus foreign illegal workers are willing to work for a wage which is lower than that of the native workers' wage and is higher than the wage they would obtain in the home country. The first main issue discussed in the paper is the effect of increasing the minimum wage on the domestic workers and the illegal workers. The existing literature deals in detail with the subject of the effect of the minimum wage on employment (see Dickens et al., 1999; Yaniv, 2001). However, there is no reference to the effect on the various groups: illegal immigrants and local workers.

Our results show that increasing the minimum wage may increase, decrease or not change the number of employed local workers but also raises the stock of illegal immigrants working in the host country. This result supports the established claim in the literature that a positive correlation exists between the wage in the host country and the number of immigrants (legal and illegal) (see Chiswick, 1999; Hanson and Spilimbero,

1999). However in our model, the rise in the stock of illegal immigrants is caused by the increased employers' demand, while in the others the reason is hidden in the increase in the immigrants' supply which is triggered by a wage differential.

The second main issue deals with the optimal enforcement budget. The politicians determine the optimal enforcement budget based on the employers' and the illegal immigrants' behavior which was examined in the first part while taking into consideration the public interest. Following Epstein and Nitzan (2006), we assume two interest groups: native unskilled workers who are harmed by the illegal immigration and the capital owners who benefit from it. Finally, we study the effect of a change in the minimum wage on the optimal enforcement budget. We show that the relationship between the optimal enforcement budget and the minimum wage depends on the groups' relative strength. If the workers' union is strong, then increasing the minimum wage increases the optimal enforcement, and *vice versa* if the capital owners are the strong group.
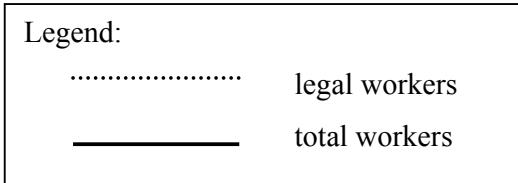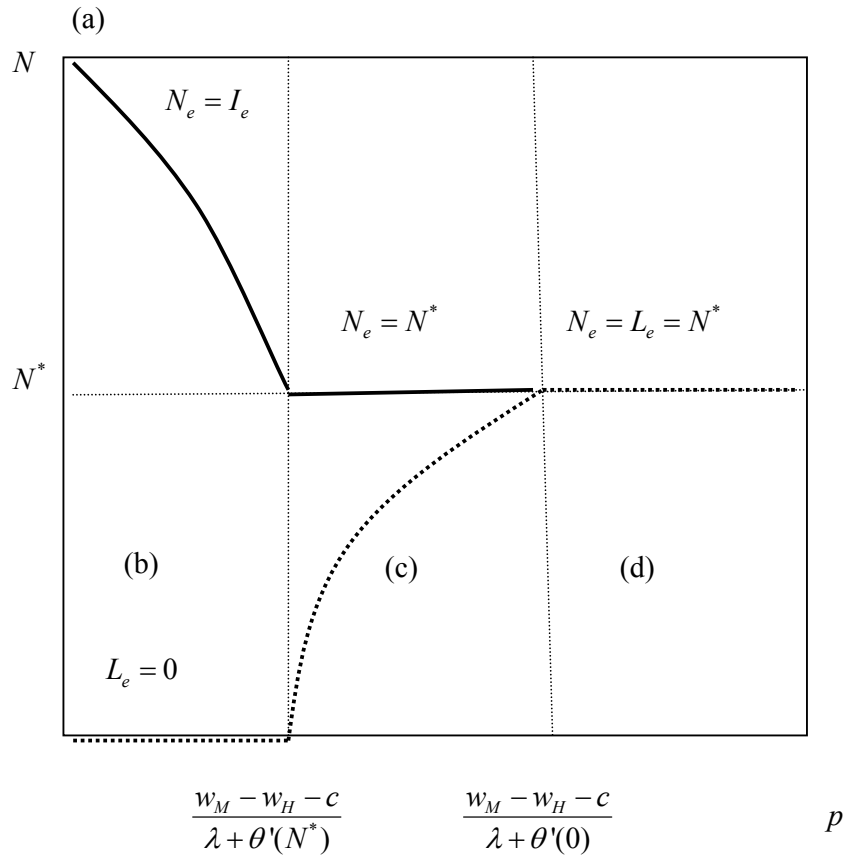
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**Figure 1. The optimal total number of workers and illegal workers**

Figure 1. The optimal total number of workers and illegal workers

(a)

N

$N_e = I_e$

$N_e = N^*$

$N_e = L_e = N^*$

N^*

(b)

(c)

(d)

$L_e = 0$

$$\frac{w_M - w_H - c}{\lambda + \theta'(N^*)}$$

$$\frac{w_M - w_H - c}{\lambda + \theta'(0)}$$

p

Legend:

.... legal workers

—————— total workers

Figure 2. The effect of increasing the minimum wage

$$\frac{w_M^1 - w_H - c}{\lambda + \theta'(N^{**})} \qquad \frac{w_M^1 - w_H - c}{\lambda + \theta'(0)} \qquad\qquad p$$

Legend:

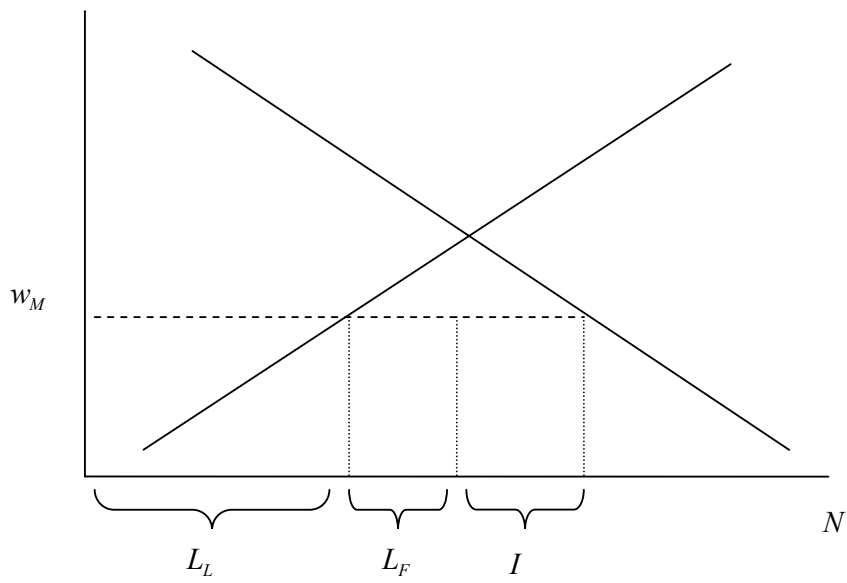– – – – – – – legal workers
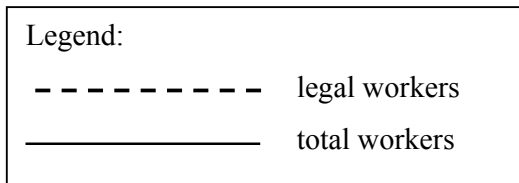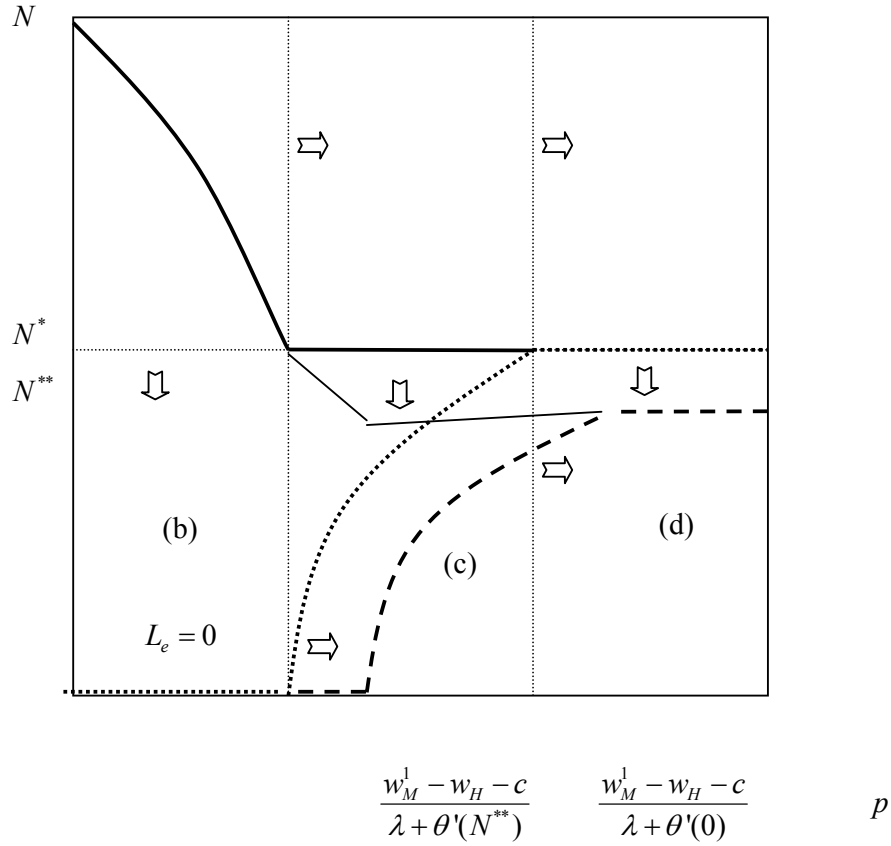
———————— total workers

Figure 3.1

There are local workers willing to work for the minimum wage:
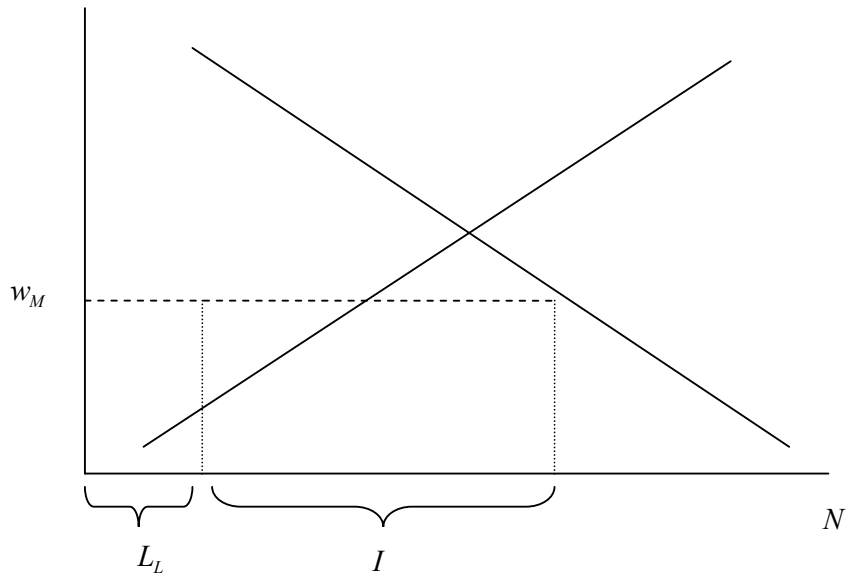
Figure 3.2

There are no local workers willing to work for the minimum wage:

Appendix A

Proof that when $L_F = 0$ then $\dfrac{\partial^2 L_L}{\partial w_M \partial E} > 0$. __The intuition is as follows:__ When the minimum wage rises more local workers wish to work, unemployment among the local population increases, and the effect of change in the enforcement budget on the employed local workers (i.e., $\dfrac{\partial L_L}{\partial E}$) increases.

The formal proof:

If $L_F = 0$, then $L_L = N - I$, hence

(A.1) $\quad \dfrac{\partial L_L}{\partial E} = \dfrac{\partial N}{\partial E} - \dfrac{\partial I}{\partial E}$

It is known that $\dfrac{\partial N}{\partial E} = 0$, so from equation (A.1) we obtain

(A.2) $\quad \dfrac{\partial L_L}{\partial E} = -\dfrac{\partial I}{\partial E}$,

From equation (6.1) it follows that:

(A.3) $\quad \dfrac{\partial w_M}{\partial I} = p\theta''(I)$,

Hence,

(A.4) $\quad \dfrac{\partial I}{\partial w_M} = \dfrac{1}{p\theta''(I)}$,

From equation (A.4) it follows that

(A.5) $\quad \dfrac{\partial^2 I}{\partial E \partial w_M} = -\dfrac{\left(\dfrac{\partial P}{\partial E}\theta''(I) + p\theta'''(I)\dfrac{\partial I}{\partial E} \right)}{\left(p\theta''(I) \right)^2}$

Under the above assumptions [see assumption (5)] the third derivative of the penalty $\theta'''(I)$ equals zero. This assumption simplifies matters. Alternatively, it can be assumed that $p\theta'''(I)\dfrac{\partial I}{\partial E}$ is very small or equals zero.

Hence,

(A.6) $\dfrac{\partial^2 I}{\partial E \partial w_M} < 0$,

From equation (A.2) together with (A.6), we obtain

(A.7) $\dfrac{\partial^2 L_L}{\partial E \partial w_M} > 0$.

Appendix B

Proof of proposition 3:

From setting $\dfrac{\partial I}{\partial E} = -\dfrac{\partial L_L}{\partial E}$ (see appendix A) into equation (31), we obtain:

$sign\left\{\dfrac{\partial E^*}{\partial w_M}\right\} = sign\left\{\alpha \dfrac{\partial^2 L_L}{\partial w_M \partial E} w_M + (2\alpha - 1)\dfrac{\partial L_L}{\partial E}\right\}$. The sign of $\dfrac{\partial E^*}{\partial w_M}$ is positive if and

only if $\alpha > \dfrac{\dfrac{\partial L_L}{\partial E}}{2\dfrac{\partial L_L}{\partial E} + \dfrac{\partial^2 L_L}{\partial E \partial w_M} w_M}$, all the components of this expression are positive, so

$\dfrac{\dfrac{\partial L_L}{\partial E}}{2\dfrac{\partial L_L}{\partial E} + \dfrac{\partial^2 L_L}{\partial E \partial w_M} w_M} < \dfrac{1}{2}$. And *vice versa*, if $\alpha < \dfrac{\dfrac{\partial L_L}{\partial E}}{2\dfrac{\partial L_L}{\partial E} + \dfrac{\partial^2 L_L}{\partial E \partial w_M} w_M}$ then the

employers' political strength, $1 - \alpha$, is high and $sign\left\{\dfrac{\partial E^*}{\partial w_M}\right\} < 0$.

Appendix C

The effect of raising the minimum wage on the capital owners' profits:

From equation (3) we obtain:

(C.1) $\dfrac{\partial E(\Pi_E)}{dw_M} = VF'(N)\dfrac{\partial N}{\partial W_M} - (N - I) - w_M\left(\dfrac{\partial N}{\partial w_M} - \dfrac{\partial I}{\partial w_M}\right) - \dfrac{\partial I}{\partial w_M} w_I - p\theta'(I)\dfrac{\partial I}{\partial w_M}$,

From equation (6), we obtain:

(C.2) $p\theta'(I) = w_M - w_I$ and $VF'(N) = w_M$,

Substituting (C.2) into (C.1) gives us:

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(C.3) $\dfrac{\partial E(\Pi_E)}{dw_M} = w_M \dfrac{\partial N}{\partial W_M} - (N - I) - w_M \left(\dfrac{\partial N}{\partial w_M} - \dfrac{\partial I}{\partial w_M} \right) - \dfrac{\partial I}{\partial w_M} w_I - (w_M - w_I) \dfrac{\partial I}{\partial w_M}$,

Equation (C.3) can be rewritten as:

(22) $\dfrac{\partial E(\Pi_E)}{dw_M} = I - N$,

It is clear that $N > I$, hence $\dfrac{\partial E(\Pi_E)}{dw_M} < 0$.