Unemployed immigrants and voter sentiment in the welfare state

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Abstract

Adverse voter sentiment can arise when immigrants are unemployed and receive tax-financed income transfers. The explanation for unemployment however determines the consequences for the local population, and an efficiency-wage explanation for unemployment is consistent with mutual benefit to national workers and employers from the presence of unemployed immigrants receiving tax-financed income transfers. The mutual benefit requires credible labor-market disciplining through job offers to immigrants and willingness of immigrants to accept job offers. Acceptance of job offers results in displacement in employment of national workers by immigrants, which can compromise the effectiveness of efficiency wages as a counter to anti-immigrant voter sentiment in the welfare state.

Keywords: Immigration policy; Unemployment; Voters; Welfare state

1. Introduction

Studies of the political economy of immigration policy investigate voters’ attitudes to immigrants (see for example Mazza and van Winden, 1996; Benhabib, 1996; Hillman and Weiss, 1999). Such studies require an underlying basis that explains why a voter might personally support or object to immigration. One basis

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that identifies personal gains and losses from immigration is the standard full-employment model of international trade and factor movements (see Kai-yiu Wong, 1995), where voter sentiment to immigration is derived from changes in real incomes, with some persons (generally described as factor owners) gaining from immigration and others losing.

There are, on the other hand, circumstances where there are no domestic losers from immigration. Fuest and Thum (2001) propose, for example, that immigration can result in skill upgrading that is beneficial for all domestic workers.

Alternatively, everyone in a local population can benefit when immigration reduces the domestic per capita tax burden for financing collective goods (Arad and Hillman, 1979). Or there can more generally be mutual benefit for a local population when immigration expands the domestic tax base, and for example allows public financing of intergenerational transfers that might otherwise be unsustainable because of demographic imbalance in the local population (see Lee and Miller, 1998; Bonin et al., 2000; Storesletten, 2000; Hillman, 2002).

Such benefits from an expanded tax base require that immigrants add to the tax-paying population. If unemployed immigrants are beneficiaries of tax-financed income transfers, immigrants increase government expenditures rather than adding to the domestic tax base. Voters perceiving the tax-financed income transfers to immigrants might then raise questions about the benefits from immigration.1

There are however circumstances where tax-financed transfers to unemployed immigrants can be socially beneficial, with no personal losses whether voters earn income from labor or from ownership of capital. The circumstances arise when unemployment is explained by efficiency wages (see Shapiro and Stiglitz, 1984).

In this paper we investigate the efficiency-wage case for benefit from immigration in a welfare state. There are of course explanations of unemployment other than efficiency wages. A minimum-wage explanation of unemployment views unemployed immigrants as unable to find jobs because immigrants’ productivity does not justify payment of the minimum wage. An insider–outsider theory of unemployment (see Lindbeck and Snower, 1988) views insiders as paying themselves above market-clearing wages and using contrived means to protect their rents from outsiders who wish to work but remain unemployed. Immigrants according to insider–outsider theory are unemployed because they are natural outsiders.

If the reason for unemployment of immigrants is minimum wages or insider rent protection, there are no benefits to national voters from the presence of unemployed immigrants receiving tax-financed income transfers, other than the altruistic feeling of giving to the less unfortunate or participating in humanitarian assistance. There is of course also the possibility in principle that unemployed

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1For empirical evidence on tax-financed income transfers to unemployed immigrants in a welfare state (the Swedish case), see Hansen and Lofstrom (1999). Wellisch and Walz (1997) correspondingly point out how the welfare state can affect the choice between free trade in goods and free immigration.
immigrants are content not to work, given the income transfers of the welfare state in which they have chosen to reside (see Buchanan, 1975).

An efficiency-wage view of unemployment suggests, however, a source of benefit for voters from welfare-assisted unemployed immigrants. Given the inevitably of unemployment in the efficient worker-disciplining equilibrium, domestic labor might prefer that someone else be unemployed. Immigrants accept this role, against the alternative of the quality of life offered in the countries that they have chosen to leave.

In our model, employed workers pay the taxes that finance income transfers to the unemployed, and immigrants at first displace national workers from the unemployment pool. The real wage declines because of immigration, but the probability of a local worker being employed increases. Although employed workers finance the income transfers to the unemployed, immigration within designated bounds increases the expected utility of local workers. Since employers benefit from immigration, immigration policies exist that are mutually beneficial for all voters whether voters are local employees or employers, although employers will want more immigrants than workers.

Efficiency wages can therefore rescue the welfare state from adverse voter sentiment when immigrants are unemployed and benefit from tax-financed income transfers. The credibility of unemployed immigrants as a labor-market discipline requires, however, that immigrants receive job offers and are willing to accept the offers. If the job offers are made and accepted, immigrants over time displace local workers from employment. Employment displacement compromises the efficiency wage as a counter to adverse voter sentiment to immigration. Adverse voter sentiment is then however not based on the income transfers of the welfare state, but on the loss of jobs to immigrants.

We proceed in Section 2 to set out the model. Section 3 is concerned with policies. The final section summarizes the conclusions.

2. The model

We consider a population that consists of owners of capital and workers. Workers consist of $N_f$ nationals and $N_i$ immigrants. All workers are risk neutral and averse to effort. The utility of workers is separable and linear in private consumption that is provided through expenditure of a wage $w$ and in the level of effort $e$,

$$U(w, e) = w - e.$$  \hspace{1cm} (1)

\footnote{The efficiency-wage explanation for unemployment has, of course, similarities with Karl Marx’s (1887) idea of the ‘reserve army of the unemployed’ as a device by employers to maintain worker discipline.}
Effort is dichotomous, at zero or positive. An unemployed worker receives benefits of \( w \), from the state and exerts no effort so that \( e = 0 \). Welfare payments are the same for nationals and immigrants (immigrants are legal). An immigrant has greater expected income than in the country he or she has left.

A worker of type \( j \) (\( j = F, L \)) has a probability \( p_j \) of becoming unemployed for exogenous reasons that do not depend on the employer. All workers maximize present discounted utility, with a rate of time preference \( r > 0 \). The model is set in continuous time. The only choice that a worker makes is selection of effort \( e \). A worker who does not shirk performs at a customary level of effort for the job, receives the wage \( w \), and retains his or her job until he or she exogenously becomes unemployed. Employers imperfectly monitor effort. Workers who shirk are detected and fired with probability per unit of time \( q \).

\( V(s, j) \) and \( V(n, j) \) are expected lifetime utilities of an employed worker of type \( j \) when shirking (s) and when not (n). \( V_u \) is the expected lifetime utility of an unemployed person. For a shirker,

\[
rv(s, j) = w - (p_j + q)(V(s, j) - V_u)
\]  
and for a non-shirker,

\[
rv(n, j) = w - e - p_j(V(n, j) - V_u)
\]  

From (2) and (3), we have:

\[
V(s, j) = \frac{w + (p_j + q)V(s, j)}{r + p_j + q} \quad \text{and} \quad V(n, j) = \frac{(w - e) + p_jV(s, j)}{r + p_j}.
\]

No shirking takes place if and only if \( V(s, j) \equiv V(n, j) \) i.e.,

\[
w \geq rV(s, j) + \frac{(r + p_j + q)}{q} e
\]

Production functions for firms are \( f(\tilde{K}, L) \) where \( \tilde{K} \) is available capital and \( L \) is the number of employed workers. The incomes of owners of capital (or employers) increase when the number of workers who are employed increases.\(^3\) Demand for workers is given by their value of marginal product, and is a decreasing function of the wage \( w \). An equilibrium is defined as an outcome where owners of capital, taking as given wages and employment levels at the other firms, find it optimal to offer the going wage rather than a different wage, that is, there is a Nash equilibrium in wages paid by employers. The sole variable determining employers’ decisions is the disciplining of employed workers through \( V_u \), the expected utility of an unemployed worker.

\(^3\)Because of diminishing marginal product of labor.
Since all unemployed workers receive the same welfare benefits \( w_{u} \), \( V_{u} \) is common to all employees. An unemployed person’s utility is thus independent of the identity of his or her previous employer. Hence

\[
r_{V_{u}}(j) = w_{0} + k_{j}(V_{u}(j) - V_{u}(j))
\]

(6)

where \( k_{j} \) is the rate at which workers who are unemployed find jobs and \( V_{u}(j) \) is the expected utility of an employed worker of type \( j \), which in equilibrium equals \( V_{u}(n, j) \). Substituting (6) into (4), we obtain

\[
r_{V_{u}}(j) = \frac{(w - e)(k_{j} + r) + w_{u}p_{j}}{k_{j} + p_{j} + r} \quad \text{and} \quad r_{V_{u}}(j) = \frac{(w - e)k_{j} + w_{u}(r + p_{j})}{k_{j} + p_{j} + r}
\]

(7)

Then, substituting (7) into (5), we determine that worker \( j \) will not shirk if

\[
w \geq w_{0} + e + \frac{e}{q}(k_{j} + p_{j} + r)
\]

(8)

The efficiency wage is defined as the lowest wage that satisfies (8).

We wish to express the efficiency wage as depending on the level of unemployment. We therefore denote by \( L_{j} \) total employment of individuals of group \( j \) and by \( N_{j} \) the total potential labor supply of group \( j \), with \( N_{L} > N_{F} \). In a steady state,

\[
k_{j} = p_{j} \frac{L_{j}}{N_{j} - L_{j}}
\]

(9)

The probability of job loss independent of the employer’s decision quit rate, \( p_{r} \), is an increasing function of the rate of employment \( L/N \) where \( N = N_{L} + N_{F} \) and \( L = L_{L} + L_{F} \) (since the lower is unemployment, the more willing is a worker to leave a job for extraneous personal reasons). Hence

\[
p_{j} = f_{j} \left( \frac{L}{N} \right) \quad \text{such that} \quad \frac{\partial f_{j} \left( \frac{L}{N} \right)}{\partial \left( \frac{L}{N} \right)} > 0
\]

(10)

From (10), (9), and (8), the condition that a worker of type \( j \) will not shirk is

\[
w \geq w_{0} + e + \frac{e}{q} \left( f_{j} \left( \frac{L}{N} \right) \frac{N_{j}}{N_{j} - L_{j}} + r \right)
\]

(11)

and the equilibrium efficiency wage is where (11) holds with equality. We see that immigration affects the efficiency wage through

\[
\frac{\partial w}{\partial N_{F}} \geq \frac{e}{q} \frac{\partial f_{L} \left( \frac{L}{N} \right)}{\partial N_{F}} \frac{(\eta - 1)L_{F}}{N^{2}} \frac{N_{L}}{(N_{L} - L_{L})} \quad \text{(12)}
\]
η is the elasticity of the aggregate employment with respect to the potential workforce
\[
\eta = \frac{\partial L}{\partial N} \cdot \frac{N}{L}.
\]
In the efficiency-wage model, \( \eta < 1 \): that is, the number of employed workers cannot increase proportionately more than an increase in the total potential workforce. An increase in the number of immigrants therefore increases unemployment, so enhancing labor-market disciplining, and the efficiency wage in (12) falls.

2.1. Income transfers to the unemployed

We now establish how income transfers to the unemployed affect the equilibrium. Substituting the steady-state relationship \( k_j = f_j L_j / (N_j - L_j) \) (see (9) and (10)) into (8), we see that a worker of type \( j \) will not shirk if
\[
w \geq w_o + e + \frac{e}{q} \left( f_j \frac{N_j}{N_j - L_j} + r \right) \quad \forall j \neq i \text{ and } i, i = L, F
\]
(13)

From (13), the willingness-to-exert effort function is
\[
L_j = N_j \left( 1 - \frac{f_j e}{qw - qw_0 - er - eq} \right) \quad \forall j = L, F
\]
(14)
The aggregate function is therefore
\[
L = L_L + L_F = N - \frac{(N_L f_L + N_F f_F) e}{qw - qw_0 - er - eq}
\]
(15)
From (8), \( qw - qw_0 - er - eq > 0 \). (15) therefore expresses the positive relation between the efficiency wage \( w \) and willingness-to-exert-effort that underlies the efficiency wage explanation for unemployment. We also observe that the higher are income transfers, the lower is willingness to exert effort.

2.2. Labor-market equilibria

From (14), since
\[
\frac{\partial f_L}{\partial L} > 0, \quad \frac{\partial \left( \frac{L}{N} \right)}{\partial N} < 0
\]
and
\[
\frac{\partial N}{\partial N_F} = \frac{\partial N}{\partial N_L} = 1,
\]

we have
\[
\frac{\partial L_L}{\partial N_F} = -\frac{N_L e}{qw - qw_0 - er - eq} \frac{\partial f_L}{\partial \left(\frac{L}{N}\right)} \frac{\partial \left(\frac{L}{N}\right)}{\partial \frac{\partial N}{\partial N_F}} > 0 \tag{16}
\]

and
\[
\frac{\partial L_L}{\partial N_L} = \left(1 - \frac{f_L e}{qw - qw_0 - er - eq}\right) \frac{N_L e}{qw - qw_0 - er - eq} \frac{\partial f_L}{\partial \left(\frac{L}{N}\right)} \frac{\partial \left(\frac{L}{N}\right)}{\partial \frac{\partial N}{\partial N_L}} > 0 \tag{17}
\]

That is, immigrants increase local workers’ willingness-to-exert effort, and a downward shift takes place in the willingness-to-exert effort function. Wages in the new equilibrium are determined by equality of demand and the aggregate willingness-to-exert effort that takes account of both the domestic and immigrant workers. In equilibrium, wages decrease. When effort does not decline precipitously in response to the lower wage, and when demand for labor is sufficiently elastic, employment of domestic workers increases.\(^5\)

An important question is who obtains the new jobs. If national workers have priority, immigrants ‘push’ national workers into employment—at a lower wage than before immigration (otherwise the additional jobs would not be available).

**2.3. The financing of income transfers**

We shall place the entire tax burden of financing income transfers received by the unemployed on employed labor. For benefits \(w_o\) paid to both local and immigrant unemployed workers, the tax per employed worker that finances the income transfers is:
\[
\text{Tax} = \frac{(N - L)}{L} w_o = \frac{(N_F + N_L - L_L - L_F)}{L_L + L_F} w_o \tag{18}
\]

Employed workers do not shirk if

\(^5\)Completely inelastic demand would of course allow for no increase in employment, nor would an extreme effort response. See Appendix A for more detail.
An increase in the number of immigrants affects the efficiency wage through:

\[ \frac{\partial w}{\partial N} = \frac{w_0}{L} \left( \frac{(1-\eta)N}{L^2} + \frac{e}{q} \frac{\partial f_t}{\partial N} \left( \frac{L}{N} \right) \left( \frac{L(\eta-1)}{N^2} \frac{N_t}{(N_t - L_t)} \right) \right) \]  

There are two countervailing effects on the willingness of workers to exert effort. More immigrants increase the tax levied on employed workers, which reduces willingness-to-exert effort. However, as the number of immigrants increases, the threat of dismissal to local workers increases, which increases employed workers’ willingness to exert effort. A necessary and sufficient condition for immigration to increase the willingness of the local individuals to exert effort is

\[ \frac{\partial w}{\partial N} = w_0 \left( \frac{(1-\eta)L}{L^2} + \frac{e}{q} \frac{\partial f_t}{\partial N} \left( \frac{L}{N} \right) \left( \frac{L(\eta-1)}{N^2} \frac{N_t}{(N_t - L_t)} \right) \right) < 0 \]

We therefore establish an upper bound on income transfers for immigrants to increase discipline on employed workers. Income transfers cannot exceed

\[ w_0 < \frac{e}{q} \frac{\partial f_t}{\partial N} \left( \frac{L}{N} \right)^2 \frac{N_t}{(N_t - L_t)} \]  

Clearly, income transfers to the unemployed that are too high blunt the disciplining effect of an increase in the unemployment pool (or, to Karl Marx’s term, the size of the reserve army), since being unemployed is less attractive. The taxes levied on employed workers to finance welfare payments at the same time make effort exertion less attractive, because of the lower loss of net income if found shirking.

There is also a lower bound to income transfers \( w \). The lower bound is the minimum income required to attract immigrants, or to have them stay and not go elsewhere.

The lower and upper bounds on income transfers establish the condition ensuring that additional immigrants increase willingness to exert effort:

\[ w < w_0 < \frac{e}{q} \frac{\partial f_t}{\partial N} \left( \frac{L}{N} \right)^2 \frac{N_t}{(N_t - L_t)} \]  

We can therefore summarize that willingness to exert effort depends on taxes paid to finance income benefits for the unemployed. If benefits are in the range determined by (23), immigration increases discipline on employed workers.

At the same time, if income benefits to the unemployed are sufficiently high, or
the number of immigrants is sufficiently large, immigrants displace national workers from employment. Also, the upper bound on benefits decreases with the number of immigrants.

2.4. Low benefits for immigrants

If immigrants receive differentially lower benefits, or no benefits at all, then immigrants may be placed in a position of offering to join the labor force at any wage offered. National workers, if they receive higher unemployment or welfare benefits, at the same time do not mind being unemployed as much as immigrants. From Eq. (11), national workers’ willingness-to-exert-effort is a function of the efficiency wage: \( L = v(w) \). The total willingness-to-exert-effort function is

\[
L' = L_L + L_F = v_L(w) + N_F
\]

where \( N_F \) is the number of immigrants. An increase in labor supply due to immigration decreases the equilibrium efficiency wage and now also decreases employment of local workers. Yet an increased probability of employment or exit from the unemployment pool is the sole source of gain for national workers from increased immigration.

If benefits for unemployed immigrants are discriminately low and immigrants displace local workers in employment, national workers therefore cannot gain from immigration. National workers therefore can gain from immigration only if the immigrants receive tax-financed income transfers.

3. Policy decisions

We now apply the above analysis to consider policy decisions. The upper part of Fig. 1 shows the level of tax-financed income transfers to the unemployed \( w \) and the number of immigrants \( N_F \). The preferred policies of employers and national workers are at the points \( A \) and \( B \) respectively, and \( AB \) is the contract curve for the choice of policies.

Employers wish income transfers \( w \) to the unemployed to be low, to increase the attractiveness of being employed. Employers would therefore choose income transfers at the lower bound \( w = w_0 \leq w \), as shown at the point \( A \). National workers want higher income transfers, between the lower and upper bounds such as at the point \( B \).

Immigrants benefit employers by increasing employment decreasing the wage.

\[\text{(24)}\]

\^[1]For proof see Appendix B.
Fig. 1. Policy choice.
Employers want more immigrants than national workers (there are more immigrants at $A$ than at $B$).

Expected utility of workers is given by

$$E^U(w, e) = \left[ Pr_j \left( w^* - w_0 - \frac{N - L}{L} - e \right) + (1 - Pr_j)w_0 \right] \frac{1}{r}$$

(25)

Pr$_j$ is the probability that the national worker is employed and has utility

$$\left( w^* - w_0 - \frac{N - L}{L} - e \right).$$

The probability of unemployment is $(1 - Pr_j)$, in which case the worker receives benefits $w_0$ and exerts no effort ($e = 0$). The probability that a local worker is employed is, in the steady state, equal to the proportion of employed persons, $Pr_j = L^*_L / N_L$. At the workers’ preferred point $B$,

$$\frac{\partial E^U(w, e)}{\partial w_0} = 0, \quad \frac{\partial E^U(w, e)}{\partial N_F} = 0.$$ 

The lower part of Fig. 1 shows the expected utility of workers $E^U(w, e)$ and the utility of employers $U^E$. The number of immigrants increases from the origin along $OB$ and workers’ expected utility is again maximized at the point $B$. Along the segment $OB$, both national workers and owners of capital benefit from increases in the number of immigrants. Employers want more immigrants than at $B$, but beyond $B$ the expected utility of workers declines.

Two alternative forms for the utility possibility frontier beyond $B$ show preferred immigration for employers at $A_1$ and $A_2$. If the utility-possibility frontier is $OBA_1$, immigration at levels between $B$ and $A_1$ (such at $C_1$) is beneficial for both workers and employers compared to a policy of no immigration at the origin $0$. $OBA_2$ shows outcomes where workers and employers can both lose from immigration, but policies are available (such at $C_2$) that are mutually beneficial for employers and workers.

Along $OB$ there is consensus among employers and workers that the number of immigrants should be increased. The point $B$ is the majority voting equilibrium if workers are the majority (if the median voter is a worker). $A_1$ or $A_2$ is the majority voting equilibrium if employers are the majority (or if employers determine policy through the institutions of representative democracy of the society).

A government choosing policy to trade-off the interests of employers and workers would choose a policy at a point such as $C_1$, or at $C_2$, where there is mutual benefit to workers and employers from immigration. The contours at $C_1$ and $C_2$ show political trade-offs between the interests of national workers and employers.

In political equilibria such at $C_1$ or $C_2$, workers would express discontent that there are too many immigrants and employers that there are too few. Although
national workers prefer the outcome at \( B \), they have nonetheless have gained from the presence of unemployed immigrants receiving tax-financed income transfers.

4. Conclusions

We have shown how, if unemployment is explained by efficiency wages, the presence of unemployed immigrants receiving tax-financed income transfers can be beneficial for both national workers, as well as employers—although workers and employers\(^6\) will be in disagreement about whether immigration should be decreased or increased.

Our model has supposed that local workers have advantages that provide priority in receiving job offers, and that immigrants remain disproportionately unemployed. The benefit from unemployed immigrants requires that unemployed immigrants receive and accept job offers. Should immigrants refuse to accept job offers that are made, taxpayers can come to see themselves as caught in the type of social dilemma described by James Buchanan (1975), where some people prefer to receive income transfer payments rather than work for a living.

If immigrants however accept job offers, as they are required to do for their unemployed status to be a credible efficiency-enhancing discipline, then immigrants displace local workers from employment. We have observed that such displacement will in particular tend to occur if unemployed national workers receive higher income transfers than unemployed immigrants. A source of anti-immigrant sentiment is then the feeling by national workers that they have lost their jobs to immigrants.

Unemployment need not, of course, be due to efficiency wages. The efficiency wage explanation for unemployment is an assumption of our model. Unemployment might be due to minimum wages or insider rents, or can be a response to social transfers at levels that, for some people, do not make the exertion of effort in employment worthwhile. In these cases, unemployed immigrants receiving tax-financed income transfers offer no sources of economic gain for the local population.

We have also presumed that only economic motives underlie voter attitudes to immigration. Voter discontent can also arise independently of economic motives, if parts of the domestic population are averse to the ethic and cultural diversity that in general accompanies immigration. Krueger and Pischke (1996) found for example that the propensity to commit acts of violence against immigrants in unified Germany was independent of income. Non-economic objections of voters to the presence of immigrants can also reflect disutility from fear of change in

\(^6\)We do not suggest by the distinction between workers and employers that we have used in this paper that employers do not work.
social norms and customs and loss of identity (see Hillman, 2002), or a more fundamental dislike that Jean-Paul Sartre (1965) has described as a form of faith.\textsuperscript{7}

A further question is why do immigrants undertake the personal upheaval of relocation to choose unemployment and the stigma of living off the state in preference to opportunities in their own countries—and to choose to encounter at times the lack of acceptance by parts of the local population? This question is not the topic of the present paper. For purposes of this paper, we have simply assumed that immigrants are available when welfare payments are sufficiently high. An answer to why immigrants are available points to foreign living standards, and also to standards of governance and political culture in countries from which immigrants come.\textsuperscript{8}

Our model has considered only legal immigration.\textsuperscript{9} Legal presence allows immigrants to receive tax-financed income transfers when not earning income through reported employment. Illegal immigrants have unreported jobs, and in general neither pay taxes nor benefit from the income transfers provided by the state in the event of unemployment. The illegal immigrants may be quite visibly present. In Hillman and Weiss (1999), visible presence of illegal immigrants is explained as a means of containing immigrants to particular employment. Tax-base considerations suggest that, as well, permissible illegal immigration is a means of preempting welfare payments to immigrants.

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Appendix A

In this appendix we derive the conditions under which an increased number of immigrants results in efficiency-wage equilibrium with lower wages and more employment. The local and immigrants willingness-to-exert-effort function are

\textsuperscript{7}For example, commenting on election results that favored politicians who had taken anti-immigration positions, the President of Switzerland (Ruth Dreifuss) observed that: ‘Nationalism and xenophobia of the kind that underpinned big election gains last year for the Swiss and Austrian far right have always existed in Europe. What is new is the return of what was repressed’ (\textit{Herald Tribune}, January 24, 2000).

\textsuperscript{8}See Epstein et al. (1999); Hillman and Ursprung (2000).

\textsuperscript{9}On illegal immigration, see for example Djajić (1997). For a perspective on efficiency wages with illegal immigration in a dual labor market model, see Carter (1999).
given respectively by: \( L_\lambda(w, L_\nu) \) and \( L_\nu(w, a)(a \) is the number of immigrants entering the country). We have:

\[
L_w = \frac{\partial L_\lambda(w, L_\nu)}{\partial w} > 0; \quad \tilde{L}_\nu = \frac{\partial L_\lambda(w, L_\nu)}{\partial L_\nu} > 0; \\
F_w = \frac{\partial L_\nu(w, a)}{\partial w} > 0 \quad \text{and} \quad F_a = \frac{\partial L_\nu(w, a)}{\partial a} > 0.
\]

In equilibrium the demand for labor, \( D(w) \), equals the aggregate willingness-to-exert effort:

\[
L_\lambda(w, L_\nu) + L_\nu(w, a) = D(w) \quad (A.1)
\]

Denoting \( F = L_\nu(w, a) \) and \( D_w = \frac{\partial D(w)}{\partial w} < 0 \) and using the total differential of (A.1) with respect to \( a \) we confirm that increasing the number of immigrants decreases the equilibrium wage:

\[
\frac{dw}{da} = \frac{\tilde{L}_\nu F_a + F_a \tilde{L}_\nu}{D_w - L_w - F_w} < 0 \quad (A.3)
\]

From (A.3), the effect of a change in number of immigrants on the equilibrium size of the local employed workforce is:

\[
\frac{dL}{da} = \frac{L_w F_a + D_w \tilde{L}_\nu}{D_w - L_w - F_w} \quad (A.4)
\]

The denominator is negative. Thus \( dL/da > 0 \) if \( \eta^L \tilde{L}_\nu / (L_w \tilde{L}_\nu) < -\eta^D \) where \( \eta^L \) is the elasticity of the willingness-to-exert effort and \( \eta^D \) is the elasticity of demand (which is negative). The outcome therefore depends on the elasticities of demand and willingness-to-exert-effort function.

**Appendix B**

If unemployed immigrants receive no income transfers, immigrants may offer to join the labor force at any wage offered. In this case \( F_w = \frac{\partial L_\lambda(w, L_\nu)}{\partial L_\nu} < 0 \) and \( F_a = \frac{\partial L_\lambda(w, a)}{\partial a} = 1 \). (A.3) holds. However, in becomes negative. Immigrants therefore displace local workers in employment.

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