Wage Drift, Immigration, and Union Behavior*

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Abstract

We analyze the effect of immigration on employment in a model accounting for the wage–drift phenomenon (the positive relationship between the minimum wage and the aggregate wage span) that characterizes the German labor market. Wage drift is explained by an employment magnification effect resulting from structural shifts of employment. The presence of the magnification effect has surprising implications for the impact of immigration on employment and on unions' wage claims. For plausible parameter values, immigration raises employment of the home labor force even if all immigrants find employment, and immigration is not expected to act as a disciplinary device for unions.

Keywords: immigration, unemployment, efficiency wage, wage drift, wage span

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1 Introduction

Immigration of labor is widely considered as a threat to the labor–market prospects of the home labor force. Native workers directly competing with immigrants typically fear an erosion of their wage incomes or even a loss of their jobs. In labor markets where union behavior plays an important role in the determination of wages, the impact of immigration decisively depends on how unions' wage policies react to immigration. Unions are typically expected to be disciplined by immigration when native workers are replaced by immigrants and thus either become unemployed (Schmidt, Stilz & Zimmermann, 1994; Bauer & Zimmermann, 1997) or are forced to apply for low–wage jobs in a secondary labor market (Fuest & Thum, 2000, 2001).

The present paper argues that at the outset it is not clear whether immigration disciplines unions in such a way that they reduce their wage claims in favor of native workers' employment prospects.[1] We work out how unions' preferences about the wage income of workers and unemployment determine the reaction of wage claims to immigration. Taking additional stylized facts of the German labor market into account, our theoretical analysis of the labor market effects of immigration casts doubts on the relevance of the replacement effect of immigration. A more aggressive wage policy becomes plausible once immigration raises employment chances of native workers. We show that a seemingly unrelated phenomenon, wage drift, is relevant for the existence of a replacement effect.

We analyze the effects of immigration on wages and employment in a simplified model of a small open economy. We assume that unemployment is mainly caused by downward rigidity of wages due to minimum wages.[2]

[1]The disciplinary force of the replacement effect may be also reduced or even reversed if unions represent the interests of heterogeneous groups of labor, e.g. skilled and unskilled labor (Schmidt et al., 1994). The present paper complements this analysis by arguing that such an augmentation of union interests is not necessary for immigration to induce more aggressive wage claims. Unions may react to immigration with more aggressive wage claims even if labor is homogeneous.

[2]The institutional differences between minimum wages and German "Tariflöhne" are of no importance in our context. Since we refer to data for West Germany only, we should properly write West Germany rather than Germany throughout.

However, although there is unemployment, wages typically are higher than the legal minimum; (relative) wage spans $(w - w^{\min})/w^{\min}$, with w as the actual wage and $w^{\min}$ as the minimum wage, are positive. As has been recognized by Gahlen & Ramser (1987) and Schlicht (1992), positive wage spans can be explained by assuming that the minimum wage influences the standard of fairness in an Akerlof–Yellen efficiency–wage model (Akerlof, 1982; Akerlof & Yellen, 1990).

The efficiency–wage approach of Gahlen & Ramser and Schlicht implies that wage spans fall if the minimum wage rises. However, as these authors have already noted themselves, aggregate data on Germany show that the average wage span *increased* with the minimum wage for the 1970ies and 80ies. Using slightly different data, we find qualitatively the same result (see appendix): the elasticity of the average wage with respect to the minimum wage is greater than 1, which means that the average wage span $(\hat{w} - w^{\min})/w^{\min}$ rises with $w^{\min}$. This phenomenon is called (positive) wage drift. In recent years, however, wage spans seem to have fallen with the minimum wage **?** implying a negative wage drift.

Schlicht (1992) attributes a positive wage drift, which is inconsistent with the results from his one–sector model, to effects of aggregation. This is a reasonable explanation. It is well known that there are persistent intersectoral wage differentials. If a rise of the minimum wage shifts employment to high–wage sectors, the average wage can increase relative to the minimum wage even if wage spans fall in every sector.

If such an explanation is correct, however, further, more surprising consequences will follow. Raising the minimum wage leads to an increase of unemployment even in a one–sector model. The shift of employment from low–wage to high–wage sectors in a multisectoral model magnifies this effect because, as Albert & Meckl (2001a,b) have shown for similar models, high–wage sectors contribute relatively more to unemployment than low–wage sectors. Immigration has the opposite effect. It would lead to more employment even in a one–sector model. In a multisectoral model with wage drift, immigration shifts employment from high–wage to low–wage sectors, implying an employment magnification effect. The surprising result is that, for plausible values of the relevant parameters, the employment magnification effect implies more employment for the home labor force even if all immigrants find employment.

This is the opposite of the replacement effect. It is obvious that unions with sufficient preferences for the income of employed workers have an incentive to appropriate at least some of the efficiency gains of immigration by raising the minimum wage. But also in a negative wage drift regime unions may react with aggressive wage claims to immigration if unions put considerable weight on employment. This counterintuitive result follows from the property of the negative–wage–drift regime where a rise in minimum wages generates an increase in aggregate employment by appropriate adjustment of the economy's sectoral structure.

The paper proceeds as follows. Section 2 introduces the model. Section 3 analyzes the effects of a change in minimum wages and of immigration. Section 4 considers union behavior in the presence of immigration. Section 5 concludes. The appendix reports a regression analysis demonstrating wage drift on the German labor market for the period from 1970 to 1995.

2 The Model

We consider an economy that can produce up to $n \geq 2$ goods using labor and $m = n - 1$ non-labor factors of production. The labor supply $\bar{L} > 0$ is exogenous, and the endowments v_i of non-labor factors are fixed. There is free trade in goods and perfect competition in all markets except the labor market, where a minimum wage $w^{\min} > 0$ exists. Goods prices p_j are fixed on world markets. The vector of goods prices is $\boldsymbol{p}$. The vector of non-labor endowments is $\boldsymbol{v}$, and the vector of respective factor prices, $\boldsymbol{r}$, is determined on perfectly competitive national markets. Sectoral production functions f_j, $j = 1, \ldots, n$, are nondecreasing, concave, and linearly homogeneous in factor inputs.

2.1 Efficiency–Wage Setting

Each worker supplies one unit of labor. One cause of involuntary unemployment is a minimum wage, which is determined by some centralized wage–

setting process. For the moment, we take the minimum wage as exogenously given. We incorporate efficiency wages as a second cause of unemployment in order to make the model consistent with two important stylized facts: the persistence of intersectoral wage differentials over time, and the existence of a positive span between minimum wages and effective wages (wage span). Our efficiency–wage approach is summarized in the following assumptions.

Assumption 1 *The sectoral labor input in efficiency units is* $g_j(w_j/\ell)L_j$*, where* ℓ *is a reference wage against which workers measure the wage offer* w_j *of sector j's representative firm.*

Assumption 2 *The function* g_j *is strictly increasing and strictly concave with* $g_j(1) = 0$ *and* $\lim_{x\to\infty} g_j'(x) = 0$*.*

These assumptions capture the essentials of Schlicht's (1992) modification of the fair–wage approach of Akerlof (1982) and Akerlof & Yellen (1990). When deciding about their effort, workers respect a fairness norm. The effort required by this norm is assumed to depend on the employer's wage offer w_j and a reference wage ℓ. Effort actually supplied by a worker is then an increasing function of the relative wage w_j/ℓ. Following a suggestion by Layard, Nickell & Jackmann (1994, 37), we assume that the relation between the productivity of labor and effort—just like any other production function—is sector–specific.

The technical assumptions on the shape of g_j are standard and give rise to proposition 1.

Proposition 1 *Efficient sectoral wages are uniquely determined by a fixed and sector–specific markup* $q_j > 0$ *on the reference wage:* $w_j = (1 + q_j)\ell$*.*

Proof. A competitive firm facing a given minimum wage $w^{\min}$ and given prices for other factors of production chooses a wage offer w_j minimizing the costs $w_j/g_j(w_j/\ell)$ of labor in efficiency units. It is necessary and sufficient for a solution that the elasticity of the function g_j is equal to 1 (Solow, 1979). In view of assumption 2, this is true at some unique value $w_j/\ell > 1$. Hence, the cost–minimizing wage offer is $w_j = (1 + q_j)\ell$ for some $q_j > 0$. ■

On the basis of the chosen wage rate $w_j = (1+q_j)\ell$ and corresponding productivity of labor $\bar{g}_j \stackrel{\text{def}}{=} g_j(1+q_j)$, firms solve the standard cost–minimization problem, treating the reference wage ℓ as a parameter:

$$b_j(\ell, \boldsymbol{r}) \stackrel{\text{def}}{=} \min_{L_j, \boldsymbol{v}^j \geq 0} \left\{(1+q_j)\ell L_j + \boldsymbol{r}.\boldsymbol{v}^j : f_j(\bar{g}_j L_j, \boldsymbol{v}^j) \geq 1\right\} \tag{1}$$

This unit–cost function has all the standard properties. The envelope theorem implies

$$(a)\ \frac{\partial b_j}{\partial \ell} = (1+q_j)a_{Lj} \qquad (b)\ \frac{\partial b_j}{\partial r_h} = a_{hj},\ \ h = 1, \ldots, m\,, \tag{2}$$

where a_{Lj} is the input coefficients of labor and a_{hj} is the input coefficient of flex–price factor h.

A major simplification in the presentation of results that are derived in the following is achieved by a change of variables. Mainly for want of a better word, we have opted for a name that has, at least, some mnemonic value.

Definition 1 *The variable* $N_j \stackrel{\text{def}}{=} (1+q_j)L_j$ *is called the labor absorption of sector* j. *The variable* $N \stackrel{\text{def}}{=} \sum_j N_j$ *is called aggregate labor absorption.*

We define production functions using the new variable:

$$\bar{f}_j(N_j, \boldsymbol{v}^j) \stackrel{\text{def}}{=} f_j\left[\bar{g}_j N_j/(1+q_j), \boldsymbol{v}^j\right] \tag{3}$$

This definition just hides the constants in f_j and can be used to write the unit–cost function as:

$$b_j(\ell, \boldsymbol{r}) \equiv \min_{N_j, \boldsymbol{v}^j \geq 0} \left\{\ell N_j + \boldsymbol{r}.\boldsymbol{v}^j : \bar{f}_j(N_j, \boldsymbol{v}^j) \geq 1\right\} \tag{4}$$

Thus, the reference wage ℓ is the price of sectoral labor absorption, and absorption enters the cost minimization problem in the same way as employment does in the standard case. Input coefficients are given by the factor-price derivatives of b_j; specifically, $a_{Nj}(\ell, \boldsymbol{r}) \stackrel{\text{def}}{=} \partial b_j(\ell, \boldsymbol{r})/\partial \ell$ is the input coefficient of labor absorption. The input coefficient of labor is $a_{Lj} = a_{Nj}/(1+qj)$.

Our specification of the reference wage is inspired by Schlicht (1992). With

Definition 2 Average labor income *is* $\bar{w} \stackrel{\text{def}}{=} \sum_j w_j L_j / \bar{L}$.

we require:

Assumption 3 *The reference wage is is an increasing, linearly homogenous, and concave function of average labor income* $\bar{w}$ *and the minimum wage* $w^{\min}$ *satisfying* $\ell(1,1) = 1$ *and* $\ell(0,1) > 0$.

These assumptions on the shape of $\ell(\bar{w}, w^{\min})$ reflect the idea that the reference wage is a weighted average of the minimum wage and average labor income.[3] Furthermore, assumption 3 implies that the reference wage function can be written as $\ell(\bar{w}, w^{\min}) \equiv h(\bar{w}/w^{\min})w^{\min}$, where h is an increasing and concave function satisfying $h(1) = 1$ and $h(0) > 0$.

In equilibrium, the relation between the reference wage and the minimum wage is determined by

Proposition 2 *In equilibrium, the wage sum is* ℓN*, average labor income is* $\bar{w} = \ell N/\bar{L}$*, and the reference wage is*

$$\ell = H\left(\frac{N}{\bar{L}}\right) w^{\min}, \tag{5}$$

where $H\left(\frac{N}{\bar{L}}\right) w^{\min}$ *is equal to the workers' reservation price of aggregate labor absorption* N *at labor supply* $\bar{L}$ *and minimum wage* $w^{\min}$*. The function* H *is increasing with* $H(0) > 0$ *and* $H(1) = 1$.

Proof. From prop. 1 and def. 1 we have $\sum_j w_j L_j = \ell \sum_j (1 + q_j) L_j = \ell \sum_j N_j = \ell N$; $\bar{w} = \ell N/\bar{L}$ then follows from def. 2.

From $\ell = h(\bar{w}/w^{\min})w^{\min}$ and $\bar{w} = \ell N/\bar{L}$ follows

$$\frac{\ell}{w^{\min}} = h\left(\frac{\ell}{w^{\min}} \frac{N}{\bar{L}}\right), \tag{6}$$

which for sufficiently small $N/\bar{L}$ has a unique positive solution $\ell/w^{\min} = H(N/\bar{L})$ since h is concave with $h(0) > 0$ and $w^{\min} > 0$. The function H

[3] The condition $\ell(0,1) > 0$ rules out an economically irrelevant boundary solution in the proof of prop. 2.

is implicitly defined by $H(x) \equiv h\,[H(x)x]$. By differentiation of this equivalence, we find that the elasticity of H at $N/\bar{L}$ is $\kappa/(1-\kappa)$, where $\kappa \in (0,1)$ is the elasticity of $h(\bar{w}/w^{\min})$ at $\bar{w}/w^{\min} = H(N/\bar{L})N/\bar{L}$. ■

The model implies positive wage spans and persistent intersectoral wage differentials. Making use of

Definition 3 *The* average wage *is* $\hat{w} \stackrel{\text{def}}{=} \sum_j w_j L_j / L$. *The* wage span of sector j *is* $(w_j - w^{\min})/w^{\min}$. *The* aggregate wage span *is* $(\hat{w} - w^{\min})/w^{\min}$. *The* bilateral wage differential between sectors j and i *is* $(w_j - w_i)/w_j$. *The* central wage differential of sector j *is* $(w_j - \hat{w})/\hat{w}$.

we get

Corollary 1 *The average wage $\hat{w}$ is equal to $\ell N/L$. For the wage spans and wage differentials of def. 3, we find:*

$$\begin{aligned} \frac{w_j - w^{\min}}{w^{\min}} &= (1+q_j)H\left(\frac{N}{\bar{L}}\right) - 1 && \text{(sectoral wage spans)} \\ \frac{\hat{w} - w^{\min}}{w^{\min}} &= H\left(\frac{N}{\bar{L}}\right)\frac{N}{\bar{L}} - 1 && \text{(aggregate wage span)} \\ \frac{w_j - w_i}{w_j} &= \frac{q_j}{q_i} - 1 && \text{(bilateral wage differentials)} \\ \frac{w_j - \hat{w}}{\hat{w}} &= (1+q_j)\frac{L}{N} - 1 && \text{(central wage differentials)} \end{aligned} \tag{7}$$

Proof. From prop. 2 (wage sum equals ℓN) and def. 3. ■

Thus, bilateral wage differentials are fixed by the technology and worker preferences and, therefore, not affected by market conditions. Central wage differentials, depending on employment and its sectoral structure as reflected in labor absorption N, are variable but will also persist over time. The reason for this persistence is that firms prefer not to employ workers at lower wages because the reduction in wage payments is not worth the loss of worker efficiency.

2.2 Equilibrium Conditions

Since firm behavior can be described by unit–cost functions with standard properties, the equilibrium allocation can be described with the help of standard techniques, the only difference being that absorption takes the place of employment.

The subsequent analysis assumes that there exists an equilibrium where firms can, in fact, behave as described in the last subsection without encountering further restrictions.

Assumption 4 *In equilibrium, employment L is not higher than the labor supply $\bar{L}$, and the efficient sectoral wages $w_j = (1 + q_j)\ell$ are not lower than the minimum wage.*

If the first condition were violated, rationing of labor would have to be considered. If the second condition were violated, at least the firms in the sector with the lowest wage would have to pay the minimum wage instead of the efficiency wage, the sectoral wage span would be zero, and the efficiency of workers would no longer be constant. Both regimes can consistently be analyzed but are of no interest in the context of the present paper.

Let $\boldsymbol{p}$ be the vector of the n exogenously given output prices p_j. The equilibrium allocation can be described with the help of the GDP function (Dixit & Norman, 1980, 44):

$$y(\boldsymbol{p}, N, \boldsymbol{v}) \stackrel{\text{def}}{=} \min_{z,\boldsymbol{r}} \; \{zN + \boldsymbol{r}.\boldsymbol{v} \colon b_j(z, \boldsymbol{v}) \geq p_j \text{ for all } j,\ z, \boldsymbol{r} \geq 0\} \tag{8}$$

The function $y(\boldsymbol{p}, N, \boldsymbol{v})$ yields the GDP (total factor income). It is non–decreasing, convex and linearly homogeneous in output prices, and non–decreasing, concave and linearly homogeneous in factor endowments. The derivatives with respect to the output prices are the equilibrium outputs; the derivatives with respect to the factor endowments are the equilibrium factor prices. The derivative with respect to labor absorption N, denoted by y_N, is equal to the shadow price of N. We assume that the GDP function is twice differentiable as a function of N, which is unproblematic since we do not have more goods than flex–price factors.

Equilibrium is described by the condition that the shadow price of labor absorption N is equal to the reference wage ℓ. Making use of (5), we arrive at

Proposition 3 *The (unique and stable) equilibrium is reached when the market price of aggregate labor absorption is equal to its reservation price:*

$$y_N(\boldsymbol{p}, N, \boldsymbol{v}) = H(N/\bar{L})w^{\min} = \ell \tag{9}$$

This condition determines aggregate labor absorption $N = N(\boldsymbol{p}, w^{\min}, \bar{L}, \boldsymbol{v})$.

Proof. Existence is assured by assumption 4. Uniqueness and stability then follow from the fact that the RHS of (9) falls with N while the LHS rises. ■

Condition (9) can be interpreted in a quite familiar way. We have already seen that a firm can view labor absorption as a factor of production. A firm seeking to buy one unit of labor absorption of optimal productivity has to pay a price of $\ell = H(N/\bar{L})w^{\min}$. If the firm paid less, it would receive one unit of labor absorption of lower productivity or, which amounts to the same thing, less than one unit of labor absorption. Hence, $\ell = H(N/\bar{L})w^{\min}$ is the lowest price at which N units of labor absorption are supplied. In other words: (9) describes the reservation price of labor absorption as a function of supply. Alternatively, we can describe the RHS of (9) as an inverse supply function of labor absorption.

In order to derive comparative-static results for an exogenously given minimum wage rate, we use the following abbreviations for two important elasticities.

Definition 4 *The elasticity of* H *is denoted by* $\theta > 0$. *The absolute value of the elasticity of* y_N *with respect to aggregate labor absorption,* $-y_{NN}N/y_N$, *is denoted by* $\eta \geq 0$.

Corollary 2 *Aggregate labor absorption* N *falls when the minimum wage* $w^{\min}$ *rises, and it rises when the labor supply* $\bar{L}$ *rises but at most by the same* *percentage:*

$$\begin{aligned} \frac{\partial N(\boldsymbol{p}, w^{\min}, \bar{L}, \boldsymbol{v})}{\partial w^{\min}} \frac{w^{\min}}{N} &= -\frac{1}{\theta + \eta} < 0 \\ \frac{\partial N(\boldsymbol{p}, w^{\min}, \bar{L}, \boldsymbol{v})}{\partial \bar{L}} \frac{\bar{L}}{N} &= \frac{\theta}{\theta + \eta} \in (0, 1] \end{aligned} \tag{10}$$

Proof. (10) is obtained from (9) by straightforeward computation. ■

2.3 Employment and Average Wage

We determine the equilibrium values of employment and of the average wage rate by evaluating the GDP function in the equilibrium determined by (9).

Corollary 3 *Employment is given by a function $L(\boldsymbol{p}, N, \boldsymbol{v})$. There are no* a priori *restrictions on $\partial L(\boldsymbol{p}, N, \boldsymbol{v})/\partial N$.*

Proof. From prop. 3, we know that sectoral labor absorptions are functions of goods prices and factor endowments (including aggregate labor absorption): $N_j = N_j(\boldsymbol{p}, N, \boldsymbol{v})$. Hence, the same holds for sectoral employment $L_j = N_j/(1 + q_j)$ and, therefore, for total employment.

We have

$$\frac{\partial L(\boldsymbol{p}, N, \boldsymbol{v})}{\partial N} = \sum_j \frac{1}{1 + q_j} \frac{\partial N_j(\boldsymbol{p}, N, \boldsymbol{v})}{\partial N} ,$$

where production theory puts no restrictions on sign or magnitude of the derivatives $\partial N_j(\boldsymbol{p}, N, \boldsymbol{v})/\partial N$ except, of course, that their sum is 1 (Dixit & Norman (1980)). Hence, there is no restriction on $\partial L(\boldsymbol{p}, N, \boldsymbol{v})/\partial N$, despite the fact that

$$\left| \frac{\partial L(\boldsymbol{p}, N, \boldsymbol{v})}{\partial N} \right| < \max_j \left| \frac{\partial N_j(\boldsymbol{p}, N, \boldsymbol{v})}{\partial N} \right|$$

because $q_j > 0$ for all j. ■

Corollary 4 *The average wage is given by a function $\hat{w}(\boldsymbol{p}, N, \boldsymbol{v})$. Its elasticity with respect to absorption is*

$$\frac{\partial \hat{w}(\boldsymbol{p}, N, \boldsymbol{v})}{\partial N} \frac{N}{\hat{w}} = 1 - \eta - \frac{\partial L(\boldsymbol{p}, N, \boldsymbol{v})}{\partial N} \frac{N}{L} . \tag{11}$$

Proof. We have $\hat{w} = \ell N/L$ (cor. 1) and $\ell = y_N$ (prop. 3); the function results from substituting $y_N(\boldsymbol{p}, N, \boldsymbol{v})$ and $L(\boldsymbol{p}, N, \boldsymbol{v})$ (cor. 3) in $y_N N/L$. The elasticity results from differentiation using prop. 3 and def. 4. ∎

Since the behavior of employment and of the average wage is tied to the sectoral structure of the economy, adjustment of these values depends, apart from the overall change of labor absorption, on whether the reallocation of absorption favors high–wage or low–wage sectors. This indeterminacy is reflected in the following results:

Corollary 5 *The comparative-static effects for employment and the average wage depend on the behavior of the employment function:*

$$
\begin{aligned}
(a)\quad & \frac{dL}{dw^{\min}}\frac{w^{\min}}{L} = -\frac{1}{\theta+\eta}\frac{\partial L(\boldsymbol{p},N,\boldsymbol{v})}{\partial N}\frac{N}{L} \\
(b)\quad & \frac{d\hat{w}}{dw^{\min}}\frac{w^{\min}}{\hat{w}} = \frac{1}{\theta+\eta}\left(\frac{\partial L(\boldsymbol{p},N,\boldsymbol{v})}{\partial N}\frac{N}{L} - 1 + \eta\right) \\
(c)\quad & \frac{dL}{d\bar{L}}\frac{\bar{L}}{L} = \frac{\theta}{\theta+\eta}\frac{\partial L(\boldsymbol{p},N,\boldsymbol{v})}{\partial N}\frac{N}{L} \\
(d)\quad & \frac{d\hat{w}}{d\bar{L}}\frac{\bar{L}}{\hat{w}} = -\frac{\theta}{\theta+\eta}\left(\frac{\partial L(\boldsymbol{p},N,\boldsymbol{v})}{\partial N}\frac{N}{L} - 1 + \eta\right).
\end{aligned}
\tag{12}
$$

Proof. From corollaries 2, 4. ∎

A priori, there is no presumption concerning the behavior of the sectoral labor absorptions N_j. Depending on elasticities of substitution, small changes of exogenous variables can lead to large reallocations of N. Therefore, even if N falls, employment can rise or fall. Whether or not this happens cannot be determined from the aggregate model described by (9); it depends on the behavior of the sectoral absorption shares N_j/N and, therefore, the production structure.

Specific results can always be derived by assuming a specific production structure as, for instance, the Heckscher–Ohlin model. Alternatively, data can be used to find the empirically relevant regime of a general model.

3 Wage Drift and Employment Effects of Immigration

3.1 Minimum Wages and Wage Drift

We define wage drift as follows:

Definition 5 Positive wage drift *means that an increase in the minimum wage* $w^{\min}$ *leads to an increase in the aggregate wage span* $(\hat{w} - w^{\min})/w^{\min}$*.* Negative wage drift *means that an increase in the minimum wage* $w^{\min}$ *leads to a decrease in the aggregate wage span* $(\hat{w} - w^{\min})/w^{\min}$*.*

With full diversification, an increase in the minimum wage leaves the reference wage unaffected. According to (9), aggregate absorption falls, and all sectoral wage spans fall. However, the average wage span can nevertheless rise through what we call an employment magnification effect.

Definition 6 *An* employment magnification effect *is said to exist iff a rise in aggregate labor absorption implies an overproportional gain in employment:*

$$\frac{\partial L(\boldsymbol{p}, N, \boldsymbol{v})}{\partial N} \frac{N}{L} > 1\,.$$

Corollary 6 *An employment magnification effect requires that an increase in labor absorption is accompanied by a reallocation of labor absorption toward low–wage sectors.*

Corollary 7 *Positive wage drift indicates the presence of an employment magnification effect exceeding* $1 + \theta$*, that is,*

$$\frac{\partial L(\boldsymbol{p}, N, \boldsymbol{v})}{\partial N} \frac{N}{L} > 1 + \theta > 1\,. \tag{13}$$

Proof. From (12b) of cor. 5. ∎

Proposition 4 *Assume that wage drift is positive. Let* $u = 1 - L/\bar{L}$ *be the equilibrium rate of unemployment. Then the following results hold for a given minimum wage rate.*

a) Immigration raises employment.

b) Immigration causes the rate of unemployment to fall iff $\theta > \sqrt{\eta}$.

c) The number of jobs created by immigration is greater than the number of immigrants iff

$$\theta > \frac{u}{2(1-u)} + \sqrt{\frac{u^2}{4(1-u)^2} + \frac{\eta}{1-u}} > \sqrt{\eta}\,.$$

Proof. Positive wage drift implies the presence of an employment magnification effect (cor. 7). Claims a,b,c) follow if one takes (13) into account when using (12c) of cor. 5. ∎

Corollary 8 *Assume full diversification and positive wage drift. Let the rate of employment be the same for immigrants and for the home labor force. Then immigration leads to higher employment of the home labor force.*

Proof. Full diversification implies $\eta = 0$; hence, the result follows from prop. 4b). ∎

4 Union Behavior and Immigration

Endogenizing the minimum wage by union wage setting requires to restrict the analysis on the special case of full diversification.

Definition 7 Full diversification *means that the number of goods produced in positive quantities is equal to* n *and the number of factors actually used in production is* $m+1$, *with* $n = m+1$.

Corollary 9 *In the case of full diversification,* $\eta = 0$ *so that* $y_N = \ell$ *is fixed at some level* $\bar{\ell}$. *Moreover, employment is linear in endowments, that is,*

$$L(\boldsymbol{p}, N, \boldsymbol{v}) = t_N(\boldsymbol{p})N - T(\boldsymbol{p}, \boldsymbol{v})\,, \tag{14}$$

where $T(\boldsymbol{p}, \boldsymbol{v}) \stackrel{\text{def}}{=} -\sum_i t_i(\boldsymbol{p}) v_i$. *There are no* a priori *restrictions on the signs of* t_N, t_i. *The average wage is given by*

$$\hat{w} = \frac{\bar{\ell}}{t_N}\left(1 + \frac{T}{L}\right) . \tag{15}$$

Proof. Linearity follows from the factor market clearing conditions. An employment magnification effect means that the elasticity of employment w.r.t. labor absorption is greater than 1, which is only possible if t_N and T are positive. The expression for the average wage uses $\hat{w} = \bar{\ell}N/L$ (see cor. 1) and (14). ■

4.1 Wage Setting Equilibrium

Consider a monopolistic union with utility function $U(\hat{w}, L/\bar{L})$ setting the minimum wage under conditions of full diversification. The union can move along the constraint (15) since N must adapt to changes in the minimum wage such that $y_N = \bar{\ell}$. Full diversification means that the union must accept the price of labor absorption as it is determined on world markets.

Let U be increasing, concave, and linearly homogeneous. The union problem is

$$\max_{\hat{w}, L/\bar{L}} \left\{ U(\hat{w}, L/\bar{L}) \colon \hat{w} = \frac{\bar{\ell}}{t_N}\left(1 + \frac{T}{L}\right) \right\} . \tag{16}$$

We focus on interior optima.

The FOC is

$$V\left(\frac{\hat{w}\bar{L}}{L}\right) \stackrel{\text{def}}{=} \frac{\partial U(\hat{w}, L/\bar{L})}{\partial (L/\bar{L})} \Big/ \frac{\partial U(\hat{w}, L/\bar{L})}{\partial \hat{w}} = \frac{\bar{\ell}}{t_N} \frac{T}{L^2} \bar{L} , \tag{17}$$

where V with $V' > 0$ is the (absolute value of the) marginal rate of substitution and the RHS is the absolute value of the slope of the constraint (15). Note that the FOC is only consistent with $T/t_N > 0$; since $T + L = t_N N$, this implies $T/(T + L) > 0$.

Let σ denote the (absolute value of the) elasticity of substitution of the utility function:

$$\sigma \stackrel{\text{def}}{=} \left(\frac{V'}{V}\frac{\hat{w}\bar{L}}{L}\right)^{-1} > 0 \tag{18}$$

From (17) and (18) we get

$$V' = \frac{1}{\sigma}\frac{T}{T+L}\,. \tag{19}$$

For any given point satisfying the FOC, we can find any value for σ since σ only measures the local curvature. Hence, as long as the SOC are satisfied, we can discuss comparative statics for different values of σ.

Differentiation of the LHS of (17) yields

$$V'\left(\frac{\hat{w}\bar{L}}{L}\right)\left(\frac{d\hat{w}}{dL}\frac{L}{\bar{L}} - \frac{\hat{w}\bar{L}}{L^2}\right) = -\frac{\bar{L}}{\sigma}\,\frac{2T+L}{T+L}\,\frac{T\bar{\ell}}{t_N L^3} < 0\,. \tag{20}$$

Differentiation of the RHS of (17) yields

$$-2\frac{T\bar{\ell}}{t_N L^3}\bar{L} < 0\,. \tag{21}$$

The SOC are fulfilled if, for higher values of L on the constraint, the indifference curves are flatter than the constraint, that is, if the LHS falls more in absolute terms than the RHS:

$$-\frac{\bar{L}}{\sigma}\,\frac{2T+L}{T+L}\,\frac{T\bar{\ell}}{t_N L^3} < -2\frac{T\bar{\ell}}{t_N L^3}\bar{L}\,. \tag{22}$$

Since $T/t_N > 0$, we can write the SOC as

$$\sigma < \frac{T+L/2}{T+L} < 1\,. \tag{23}$$

Thus, if the union's indifference curves become too flat (i.e. if $\hat{w}$ and $L/\bar{L}$ are too good substitutes from the perspective of the union), a full-diversification equilibrium with positive wage drift is not possible. Specifically, Cobb-Douglas preferences, where $\sigma = 1$, are ruled out. Note that the SOC requires $(T + L/2)/(T + L) > 0$.

4.2 Wage Setting and Immigration

Under full diversification, the reaction of employment to immigration *if the union does not adjust the minimum wage* is given by (12c) of cor. 5, together with $\eta = 0$ and $L = t_N N - T$. This yields

$$\frac{dL}{d\bar{L}}\frac{\bar{L}}{L} = \frac{T+L}{L}\,. \tag{24}$$

Note that without further restrictions the sign of this elasticity is indeterminate.

In general, however, the union will adjust its wage claims. We can use the results from the union's optimization problem in order to analysze how immigration affects the union's policy. From (17) we derive the comparative static effect on employment with respect to immigration as

$$\begin{aligned}\frac{dL}{d\bar{L}}\frac{\bar{L}}{L} &= \frac{\frac{T\bar{\ell}}{t_N L^2} - \frac{V'\hat{w}}{L}}{2\frac{T\bar{\ell}}{t_N L^2} - \frac{1}{\sigma}\,\frac{2T+L}{T+L}\,\frac{T\bar{\ell}}{t_N L^2}} = \frac{\frac{T\bar{\ell}}{t_N L^2} - \frac{1}{\sigma}\frac{T\bar{\ell}}{t_N L^2}}{2\frac{T\bar{\ell}}{t_N L^2} - \frac{1}{\sigma}\,\frac{2T+L}{T+L}\,\frac{T\bar{\ell}}{t_N L^2}} \\ &= \frac{1}{2}\,\frac{1-\sigma}{\frac{T+L/2}{T+L} - \sigma} > 0\,. \end{aligned} \tag{25}$$

The SOC (cf. (23)) imply that the union always adjusts the minimum wage in such a way that immigration leads to a positive employment effect.

If (25) and (24) are equal, union preferences require no adjustment of the minimum wage at all. We find equality if

$$\sigma = \frac{T}{T+L/2} < \frac{T+L/2}{T+L} < 1\,. \tag{26}$$

This condition is consistent with equilibrium. It depends on the union's preferences whether it will pursue a policy that counteracts the employment effects of immigration. As a result, whether immigration disciplines a union or not depends on union preferences. Irrespective of its specific preferences, however, the union does never adjust wages so dramatically that positive employment effects of immigration at a given minimum wage are reversed.

Even given union preferences, it is not clear whether the union will raise or lower the minimum wage as a consequence of immigration. The next section shows there are two different regimes with different implications for union behavior. It moreover shows that, under the assumptions made so far, the regime can be identified by observing the wage drift.

4.3 Immigration, Wage Drift and Union Behavior

We can now discuss the union's reaction to immigration under alternative wage–drift regimes. Our main result is stated in the following proposition:

Proposition 5 *Assume full diversification and positive wage drift. Unions are disciplined by immigration iff $\hat{w}$ and $L/\bar{L}$ are good substitutes from the perspective of the union: $\sigma > T/(T + L/2)$. On the other hand, immigration causes unions to raise their wage claims iff $\hat{w}$ and $L/\bar{L}$ are poor substitutes from the perspective of the union: $\sigma < T/(T + L/2)$.*
Proof. Immigration in the presence of positive wage drift implies $(dL/d\bar{L})$ $(\bar{L}/L) > 1$ and $(dL/dw^{\min})$ $(w^{\min}/L) < 0$ (see cor. 8). The result then follows from conditions (24) and (25). ■

This proposition proves our claim stated in the introduction: Unions with preferences sufficiently biased in favor of the income of employed workers have an incentive to appropriate some of the gains from immigration by raising the minimum wage.

Things are a bit more complicated in the regime of negative wage drift. Negative wage drift implies

$$\frac{\partial L}{\partial N}\frac{N}{L} < 1 + \theta\,.$$

This condition is either compatible with $(\partial L/\partial N)(N/L) < 0$ (case 1), or with $0 < (\partial L/\partial N)(N/L) < 1 + \theta$ (case 2). Thus we get

Proposition 6 *Assume full diversification and negative wage drift.*
(i) Immigration causes unions to raise their wage claims in case 1.
(ii) Immigration causes unions to raise their wage claims iff $\hat{w}$ and $L/\bar{L}$ are poor substitutes from the perspective of the union: $\sigma < T/(T + L/2)$. On the other hand, unions are disciplined by immigration iff $\hat{w}$ and $L/\bar{L}$ are good substitutes from the perspective of the union: $\sigma > T/(T + L/2)$.
Proof. Part (i) follows from cor. 8 and (25). Part (ii) follows from conditions (24) and (25) ■

5 Conclusion

Our analysis has shown how the reaction of unions to labor immigration is related to the phenomenon of wage drift determined by adjustment of an economy's sectoral structure. For given union preferences about wage incomes of employed workers and employment rates, the immigration–induced change in wage policies depends on the wage–drift regime of the economy. In the case of positive wage drift and high substitutability between wage incomes and employment, immigration does not generate a replacement effect and unions react with more aggressive wage claims. At least for german labor markets, this case has some plausibility.

Intuitively, the mechanism driving our results about wage drift works as follows. A rise in the minimum wage increases the reference wage, but by a smaller percentage. Sectoral wages, which are given by a constant sector–specific markup on the reference wage, rise but sectoral wage spans fall. If, nevertheless, the aggregate wage span rises (wage drift), this must be because the change shifts employment to high–wage sectors. This is in line with the usual assumption that a rise in minimum wages mainly endangers low–wage jobs. However, high–wage sectors contribute more to unemployment than low–wage sectors. Therefore, the wage–drift phenomenon indicates that unemployment goes up for two reasons, a macroeconomic reason and a structural reason: labor becomes more expensive, and employment shifts toward sectors which contribute more to unemployment. The additional, structural effect is called the employment magnification effect since it implies that changes in employment are larger in a multisectoral model with wage drift than in a one–sector model.

Immigration works in the other direction. It puts downward pressure on average labor income, which lowers the reference wage of workers. In a one–sector model, such a change would never be sufficient to create enough jobs to employ the immigrants, not to speak of the home labor force. In a multisectoral model with wage drift, however, the employment magnification effect extends the range of possible results. Under quite plausible assumptions, the employment magnification effect is strong enough to create more employment than necessary to employ the immigrants.

The reduction in wage spans by immigration as well as the positive effect on home employment imply that immigration does not neccessarily work as a discplining device for unions. On the contrary, immigration creates an incentive for unions to raise the minimum wage and thus to appropriate some of the gains from immigration with respect to employment.

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