Wage indexation, migration, and unemployment

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Received 12 June 1998; accepted 14 July 1999

Abstract

This article sets up a two-goods model with wage indexation and migrants. A dual labor market is introduced where the domestic workers receive an indexed wage while migrants receive a market-determined wage. The traded sector may be assumed to be unionized while the non-traded goods sector is non-unionized giving rise to flexible wages. This provides an example of segmentation and wage indexation. The wage indexation creates unemployment in the traded sector and the segmentation allows this unemployment to persist. The main results obtained are: sector-specific migration of labor may raise domestic welfare, while with capital accumulation such migration necessarily raises the relative price of the non-traded goods, leading to structural adjustment. © 2000 Elsevier Science Inc. All rights reserved.

JEL classification: F2; J4, J6; O1

Keywords: Wage indexation; Migration; Unemployment; Structural adjustment

1. Introduction

Ever since the pioneering work of Haberler (1950), trade theorists have been interested in analyzing the consequences of real wage rigidity for both unemployment and trade theory. Many articles in this context have been written under the assumption that factors of production are internationally immobile. As these factors have become increasingly mobile throughout the global economy it is important to analyze some of the consequences of such mobility in a second best framework. Many countries take immigration policy as a serious issue from several perspectives: economics, political,
sociological, and so on. Our focus here will be purely from an economics perspective. The issues analyzed are: the impact of unskilled migration and domestic capital accumulation on unemployment of domestic labor; impact of such immigration on the relative price of non-traded goods; migration and factor rewards; and most importantly, the consequences of migration on the welfare of domestic residents. The welfare of the domestic residents is separated from that of migrants as ultimately it is the vote of domestic residents that counts in the political process of deciding immigration policy. All the issues raised are of importance in policy-making, specifically unemployment and welfare. Our analysis addresses all these issues. The presence of real wage rigidities and consequent unemployment are pervasive features of many countries, hence it is important to study migration issues by explicitly specifying that wages are not perfectly flexible. In an interesting article, Das (1981) analyzed the consequences of foreign investment (internationally mobile capital) in the presence of unemployment generated from lack of flexibility of wages. This rigidity was introduced by using wage indexation. Earlier such as indexation procedure was also used by Helpman (1976) and Rodseth (1979) in the context of macroeconomic policy. However, to our knowledge, only Chao and Conlon (1993) first analyzed the impact of international migration of labor on unemployment in a trade model characterized by such wage indexation.3

This article sets up a two-goods model (two internationally-traded goods made composite into one traded goods and one non-traded goods) with wage indexation and the presence of migrants. A dual labor market is introduced where the domestic workers receive an indexed wage while migrants receive a market determined wage. Wage indexation creates unemployment of domestic workers while wage flexibility leads to full employment of migrant workers. Such a dual market can only function if the markets are segmented. Migrants in general work in lowly paid jobs, mainly in the service sector, for example, sweeping the streets in some European countries or selling junk products that are not internationally traded. It has been noted, for example, that many unskilled migrants have to work in “A3D” jobs, that is, dirty, dangerous and dull. The traded sector may be assumed to be unionized while the non-traded goods sector is non-unionized giving rise to flexible wages. This provides an example of segmentation and wage indexation. The wage indexation creates unemployment in the traded sector and the segmentation allows this unemployment to persist.

The model we are dealing with has a wage distortion and, as is well know in trade and distortion theory, it is difficult to obtain unambiguous welfare results in the presence of a distortion and this remains true in our model. The main results we obtain are summarized below. First, sector-specific migration of labor may raise domestic welfare. Domestic welfare increases when the supply effects dominate the demand effects in the non-traded goods sector. Second, with capital accumulation such migration necessarily raises the relative price of the non-traded goods. The welfare and employment effects of domestic capital accumulation are also ambiguous. The price change provides a signal for a shift in the output from producing traded goods towards non-traded goods. Such a structural change may not be in the interests of the economy in the long run. Furthermore, such changes in output composition may have adverse implications for capturing gains from the global growth in international trade. These
results provide conflicting messages to the policy maker and clearly show the conflict between welfare and domestic unemployment.

2. Model

Our model consists of two composite goods, tradable and non-tradable. These goods are produced with neoclassical production functions that exhibit constant returns to scale and diminishing returns to factors. A disaggregated model can be set up quite easily, however, it is not required to obtain the main results of this article.

The production functions are

\[ Y_T = F(K_T, L) \]  (1)
\[ Y_N = G(K_N, L_i) \]  (2)

where \( K_i (i = T, N) \) and \( L_i \) denote the allocation of capital and labor to the relevant sectors. The term \( L_i \) denotes the allocation of migrants to the non-traded goods sector. Note that the labor market is segmented since domestically-supplied labor does not work in the service sector and immigrant labor is not employed in traded goods sectors as shown by \( L \) in Eq. (1). This assumption can be relaxed without loss in generality and is only made to obtain results in a simple and neat manner.

The wage, \( W_i \), of the domestic workers is indexed to the price of the tradable and non-tradable goods as shown below:

\[ W = \phi[P_T, P_N] \]  (3)

where \( P_i (i = T, N) \) denotes the prices of the tradable and non-tradable goods. The function \( \phi \) in Eq. (3) is assumed to be homogenous of degree one. It is easy to show that the change in the real wage \( \hat{w} \), in terms of the tradable goods is [Eq. (4)]:

\[ \hat{w} = \hat{W} - \hat{P}_T = \mu_N \hat{P} \]  (4)

where \( \hat{P} \) denotes the relative price of the non-traded goods and \( \mu_N \) the price elasticity of the nominal wage. Indexation results in unemployment of the domestic workers. The wages of the migrants are not indexed and hence, migrant workers are fully employed.

The factor endowment conditions in terms of variable input coefficients are given below [Eqs. (5–7)]

\[ a_{KT} Y_T + a_{KN} Y_N = K \]  (5)
\[ a_{LT} Y_T = L \leq \hat{L} \]  (6)
\[ a_{LI} Y_N = L_i \]  (7)

where \( a_{ij} \) denote variable input coefficients \( K, L, \) and \( L_i \) the total supply of capital, domestic labor and the quota-determined supply of migrant labor, respectively.

The unit cost function for this model are given below [Eqs. (8) and (9)]:

\[ a_{LT} w + a_{KT} r = 1 \]  (8)
where \( r \) and \( w_i \) denote the rental on capital and the wage rate for migrant labor, respectively. The market clearing equation [Eq. (10)] for the non-tradable goods is:

\[
D_N[P, I] = Y_N
\]

where \( D_N \) denotes demand for the non-tradable and \( I \) total income. Note that the migrants consume the non-traded goods as well as the traded goods.

The national income from the expenditure side equals the value of total output, hence:

\[
I = D_T + PD_N = Y_T + PY_N
\]

resident income \( I_R = Y_T + PY_N - w_iL_i \) and \( D_T \) denotes the demand for the tradable goods. This completes the specification of the model.

3. Results

3.1. Increased migration

We first explore the impact of increased migration on employment, resident welfare and factor returns. By differentiating Eq. (3) to Eq. (11) and by differentiating and using Eqs. (1) and (2) we obtain:

\[
\begin{bmatrix}
\lambda_{KT} & \lambda_{KN} & \beta_K & 0 & 0 \\
\lambda_{LT} & 0 & -\beta_L & -1 & 0 \\
0 & 1 & -C & 0 & 0 \\
0 & -1 & \eta_N & 0 & \eta_{NI} \\
0 & 0 & 0 & -\theta_L & 1 \\
\end{bmatrix}
\begin{bmatrix}
\dot{Y}_T \\
\dot{Y}_N \\
\dot{P} \\
\dot{L} \\
\dot{I} \\
\end{bmatrix}
= \begin{bmatrix}
0 \\
0 \\
0 \\
0 \\
0 \\
\end{bmatrix}
\]

(12)

where \( \lambda_{ij} \) represents factor shares, \( \beta_j \) and \( C \) are the elasticities of factor substitution, \( \eta_N \) and \( \eta_{NI} \) the price and income elasticities of the non-tradable goods (\( \eta_N < 0, \eta_{NI} > 0 \)). The term \( \theta_L \) shows the share of domestic wages in national income, while \( \theta_I \) the share of migrant income in national income.

The above system is solved for the endogenous variables of interest:

\[
\dot{P} = \frac{\lambda_{KT}[m_{Nw}w_iL_i - 1] - \eta_N\lambda_{KN}\theta_L}{D}
\]

(13)

\[
\dot{L} = \frac{A'(1 - m_{Nw}w_iL_i)}{D} + \frac{B'(\eta_N - \eta_{NI}\theta_I)}{D}
\]

(14)

\[
\dot{I} = \theta_L\dot{L}
\]

(15)

\[
\dot{\hat{r}} = -\frac{\theta_L\eta_N\dot{P}}{\theta_KY}
\]

(16)
\[
\hat{w}_t = \alpha \hat{p}
\]

\[
D = \lambda_{KT} \eta_N + \lambda_{KL} C + \eta_N \theta_{LKT} \beta_L + \lambda_{LT} C \lambda_{KN} \eta_N \theta_L \]
\[
+ \lambda_{LT} \beta_K \theta_L \eta_N \theta_L > 0
\]
as \eta_N < 0 and \(C, \beta_L \beta_K\) are all positive. Also
\[
A' = \lambda_{KT} \beta_L + \lambda_{LT} \beta_K > 0
\]
\[
B' = \lambda_{KX} \lambda_{KN} > 0
\]
\[
\alpha = \frac{1}{\theta_{LX}} \left[ 1 + \frac{\theta_{KN} \theta_{LY} \mu_N}{\theta_{KY}} \right] > 0
\]
\[
\beta_L = \sigma_{LY} \mu_N
\]
\[
\beta_K = \lambda_{KT} \theta_{KL} \sigma_{KL} \mu_N + \lambda_{KN} \sigma_{KN} \theta_{LN} \left( \theta_{KT} + \frac{\theta_{KN} \theta_{LT} \mu_N}{\theta_{LN} \theta_{KT}} + \frac{\theta_{LT} \mu_N}{\theta_{KN}} \right)
\]
\[
C = \theta_{KN} \sigma_{TL} \left( \frac{\theta_{KT} + \theta_{KN} \theta_{LT} \mu_N}{\theta_{KT} \theta_{LN}} + \frac{\theta_{LT} \mu_N}{\theta_{KN}} \right)
\]
\[
m_N = \frac{P \delta D_N}{\delta Y_N}
\]

where \(m_N\) is the marginal propensity to consume the non-traded goods.

On the basis of Eqs. (13–17) we obtain the following results:

Proposition 1. An increase in sector-specific migration necessarily lowers the relative price of the non-tradable and migrant wages and raises the return to capital.

Proposition 2. An increase in sector-specific migration raises (lowers) domestic employment as:
\[
\left[ A' \left( 1 - \frac{m_N \mu_N L_t}{PY_n} \right) + B' (\eta_N \theta_t) \right] > ( < ) 0
\]

We proceed to discuss Proposition 2 using a variant of the Edgeworth-Bowley box diagram. In developing this explanation Proposition 1 is used. The dimensions of Box 1, in Fig. 1, \(OK_N O'T_L\) show the quota-determined supply of immigrant labor and the allocation of \(K\) to the non-traded goods (denoted by \(K_N\)). The production equilibrium for the non-traded goods is shown by point \(O_T\) (isoquant omitted). In Box 2 we have the inelastically given supply of domestic labor \(O_T L\) and the remaining supply of capital \(K_N M\) which is fully utilized in traded goods production. Because of wage indexation, equilibrium occurs at point \(e\) (isoquant omitted) resulting in unemployment of domestic labor as shown by \(ee'\). From Proposition 1 we know that an increase in sector-specific migration raises the section to capital and lowers the migrant wages, hence, the labor intensity in sector \(N\) increases as shown by the slope of \(OO'\). Also note that the output of \(Y_N\) increases.
We represent two cases: first, the case of an increase in domestic employment (Fig. 1); and second, the case of a decrease in domestic employment (Fig. 2), respectively. We only describe Fig. 1 in detail. Since wage indexation raises the real wage above the competitive level, unemployment results as shown by $ee'$. In a non-distortionary model, full employment equilibrium would have been observed to show a higher labor capital ratio (lower capital intensity). An increase in unskilled labor migration results in a new box $OK'O'O'Q$. Equilibrium in this sector is now shown by point $O'O'$. At this equilibrium point, all the migrants are employed and some capital is released to the production of traded goods as shown by the distance $KK'$. The availability of more capital to the production of traded goods increases domestic employment as shown by the difference between $Te'' - O'Te > 0$. In Fig. 2 we illustrate the case of increased unemployment—this arises due to the reduction in the capital available for employment in the production of traded goods. The above discussion provides the intuitive explanation for the results.

3.2. Capital accumulation

In this subsection we analyze the implications of domestic capital accumulation on domestic and migrant welfare, unemployment and relative price of the non-traded goods. The left-hand side of Eq. (12) remains the same, but the right-hand side vector changes and becomes [Eq. (18)]:
Fig. 2. Migration and decreased domestic employment.

\[
\begin{bmatrix}
\dot{K} \\
\dot{O} \\
\dot{O}
\end{bmatrix}
\begin{bmatrix}
\theta_r \\
\theta_L
\end{bmatrix}
\]

(18)

where \( \theta_r = \frac{r\dot{K}}{I} \).

By using the above right-hand side with the Eq. (12) we obtain:

\[
\hat{p} = \frac{\eta_N [\lambda k \theta_L + \theta_L]}{D} \dot{K}
\]

(19)

\[
\dot{l} = - (\eta_N - C) \frac{Y_l}{I} \dot{K}
\]

(20)

\[
\dot{L} = \left[ -\frac{\eta_N + (1 - \theta_L)m_N C}{D} - \frac{\theta_r \eta_N [\lambda k \beta_L + \beta_k]}{D} \right] \dot{K}
\]

(21)

\[
\dot{l}_r = \theta_r \dot{L}
\]

(22)

From Eqs. (19) and (20) we derive the following proposition:

Proposition 3. Capital accumulation necessarily raises total income and the relative price of the non-traded goods.
It is clear that the availability of more capital raises total income and via the income effect also raises the relative price of the non-traded goods. The increase in total income arises as capital is mobile between both sectors in contrast to migrant labor which is sector specific and has an ambiguous effect on total income. This explains the non-ambiguous effect of capital accumulation on the relative price of non-traded goods. This increase in the relative price of the non-traded goods has obvious implications for structural adjustment within the economy.

From Eqs. (21) and (22) it is clear that resident welfare and employment respond ambiguously to an increase in capital accumulation. These results are consistent with results in second best models.

4. Conclusions

This article has examined the consequences of wage indexation in a sector-specific labor model where domestic labor is specific to the traded goods sector and immigrant labor to the non-traded goods sector. Two propositions are derived which explore the consequences of increased migration on domestic welfare, unemployment and the relative price of the non-traded goods (real exchange rate). It is shown that increased migration may lead to a proposition analogous to the strong paradox in the transfer problem, that is, both resident welfare and employment fall as a result of such migration. These results show that migration policy should always be given serious consideration in the presence of unemployment.

Acknowledgments

Comments received from two anonymous referees are gratefully acknowledged.

Notes

1. See, for example, Bhagwati (1971), Brecher (1974), Johnson (1965) and Sgro and Takayama (1981).
2. The exceptions to this are among others: Bhagwati and Hamada (1974); Hamada and Bhagwati (1975); Rodriguez (1975); Djajic (1993); and Hazari (1994).
3. Wage indexation was used for several years in Australia for a majority of workers. It is still used for low paid workers in India as a dearness allowance. Many countries receive unskilled migrants both legal and illegal. For example, Europe is the recipient of a large number of unskilled workers from Africa. Foreign workers from the neighboring Arab states and from Asian countries (as a percentage of total labor force) constitute from 44% in Saudi Arabia to about 87% in the United Arab Emirates.
4. This function has been used by Brecher (1971), Helpman (1976), Rodseth (1979) and Das (1981).
References


