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Relative Price Changes, Wages and Unemployment in a Specific Factors Model with Search Frictions

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Abstract

This paper analyzes the effects of changes in the relative product price on wages and unemployment of a small open economy in a specific factors model characterized by search frictions. It shows that unemployment and wages move in opposite directions, i.e., high unemployment is associated with low wages and low unemployment with high wages. The reason for the employment effect is found to be individual wage bargaining.

1. Introduction

The effects of world market events on the domestic economy have always been a principal subject of international economics. Factor reallocations and changes in factor prices due to terms-of-trade variations are standard examples that can be studied within the Heckscher–Ohlin–Samuelson model. However, since the classic variants of the model postulate perfectly competitive labor markets, the effect of terms-of-trade changes on involuntary unemployment cannot be studied. Trade models allowing an analysis of the connection between variations in the terms of trade and employment levels mostly rely on labor market approaches where a rigid wage exceeding the full employment level is the reason for unemployment (Brecher, 1974). In the present paper, a different point of view is taken. Here, unemployment is not a consequence of equilibrium wages being too high, but rather of costly search processes. Combining this with a Jonesian specific factors model of a small open economy, we analyze how relative price changes affect sectoral employment, total unemployment and wages.

This link is of major relevance for current policy questions. Thinking of the recent EU enlargement on May 1st 2004 where 10 countries, the "new member states", joined 15 "old member states", the effect of this enlargement on unemployment and wages in old—but also in new—member states is hotly debated. As it will turn out, our model can be used to understand some of these issues for both groups of countries.

We use a search and matching model in the tradition of Diamond (1984), Mortensen (1982), and Pissarides (2000). To incorporate search unemployment into a specific factors model, a two–sector version is necessary. They were, e.g., studied by Hosios (1990) and Davidson et al. (1988, 1991, 1999). These papers share the feature that production (in sectors where matching takes place) is characterized by Leontief technologies. A match requires either exactly one worker and one firm (Hosios, 1990) or exactly two workers of different types (Davidson et al., 1988). Due to this assumption,

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firms do not have any discretion concerning the number of vacancies they want to open. In contrast, Pissarides (2000, ch. 3) uses a matching model, where firms may hire more than one worker and production technologies have the usual neoclassical properties. Yet, the model describes only a one–sector economy. Therefore, we develop an alternative two–sector model of frictional unemployment compatible with the standard assumptions of the specific factors model. In that sense, our variant is an extension of Pissarides (2000, ch. 3).

Using the two–sector search and matching model to describe the labor market in a specific factors model, we find a reallocation effect qualitatively identical to the one derived in a standard specific factors model. We also demonstrate that real wages decrease due to falling relative product prices. Again, this effect is well–known from the standard specific factors model. In addition, however, we show that total unemployment rises when relative product prices decrease. Clearly, this effect is not present in the standard model.

With an EU–enlargement perspective, a decreasing relative product price for the labor intensive good can be seen to be the result of enlargement for old member states. The labor intensive good becomes available at a lower relative price and these countries would experience lower real wages and higher unemployment. For new member states, however, where the relative product price increases, real wages would increase and unemployment would be reduced.

The results can be compared to the ones derived from other trade models with imperfect labor markets. Brecher (1974) considers a Heckscher–Ohlin–Samuelson model, where real minimum wages exist in both sectors, but in the domestic country only. He shows that employment decreases if the home country exports the capital–intensive good under incomplete specialization. The contributions of Hoon (1991) and Brecher (1992) focus on efficiency wages as the source of involuntary unemployment. Hoon (1991) demonstrates that employment decreases in the country which is relatively abundantly endowed with the factor capital when the countries start trading. Brecher (1992) examines an increase in an import tariff to investigate the effects of terms-of-trade changes on employment. He finds that protection of the relatively labor–intensive good will cause employment to rise. Hence, if the degree of protection for the labor intensive good is decreased, employment will fall. Finally, Davidson et al. (1999) also incorporate search unemployment into a Heckscher–Ohlin–Samuelson model. They use sector specific matching functions and, as mentioned above, rely on Leontief production functions so that a firm does not decide on how many jobs it wishes to offer. Apart from those differences, they focus on a different subject: that differences in the 'performance' of the labor markets may be a reason for international trade.

The present model and the contributions of Hoon (1991) and Brecher (1974, 1992) differ among, other things, in the postulated reason for unemployment. In the latter models, the reason for involuntary unemployment are wages that exceed the value marginal product compatible with full employment. In that sense, wages are too high. Further, the increase in unemployment due to a decrease in the relative product price is caused by downward rigidities of wages. The present paper uses a search and matching model. Here, the reason for the involuntary unemployment is *not* a wage being too high, but costly search processes. However, we demonstrate that the increase in unemployment due to the fall in relative product prices is again the downward inflexibility of wages. This inflexibility is driven by the individual wage bargaining process. In that sense, the results derived here are comparable to the ones of Hoon (1991) and Brecher (1974, 1992). A difference to the latter contributions arises since they base on a

Heckscher–Ohlin–Samuelson model. In this framework, employment falls only if the country exports the capital–intensive good and experiences a drop of the import relative to the export price. In the present model, the employment decreases whether the drop of the relative price is associated with a deterioration or an improvement of the terms of trade.

The model is presented in the following section. In section 3, the equilibrium of the economy forming the starting point for the succeeding analysis is described. Section 4 focuses on the effects of relative price variations. The paper concludes with section 5.

2. The Model

The economy considered here consists of two sectors X and Y each producing one homogeneous good. In every sector, there is a large number of identical firms taking prices as exogenously given. Good Y is chosen as the numéraire, e.g., because it satisfies basic needs as opposed to X which may be a luxury good. A firm employs several factors of production of which we explicitly consider only the factor labor L_i. Other factors include, e.g., a Chief Executive Officer (CEO). Hence, the underlying structure is that of the specific factors model (Ethier, 1988). Since firms are identical, the subscript i refers to a representative firm of sector i.

A firm cannot instantaneously adjust its stock of labor to the optimal level since finding a worker takes time. The indirect way to control the firms' number of employees is by posting vacancies N_i which are filled with a certain probability. The probability of a certain vacancy becoming matched to a potential worker depends on the state of the labor market characterized by the ratio between hires per unit of time $m(U, N)$ and the aggregate number of vacancies N. The matching function $m(\cdot)$ exhibits constant returns to scale and depends positively on total unemployment U and vacancies. Due to this property, the matching function can be written as $m(U, N) = Um(\theta)$ with $\theta = N/U$. The variable θ, also known as the Beveridge ratio, measures the number of vacancies per unemployed person. Therefore, its inverse is an indicator of the labor market tightness. A fixed share s of the firm's labor force leaves the firm. This separation rate represents the consequence of idiosyncratic shocks to the productivity of firms or simply retirement of a part of the work force. Combining matching and separation, the evolution of the firm's labor stock is given by

$$\dot{L}_i = \frac{m(U,N)}{N} N_i - sL_i. \tag{1}$$

Opening a vacancy is costly. Vacancy costs arise from posting the job in newspapers, selecting appropriate candidates and holding interviews. For simplicity, the costs γ per vacancy are assumed to be fixed in terms of the numéraire. The relative product prices p_i, the world interest rate r in terms of the numéraire and the Beveridge ratio θ are exogenous to the firm.[1] In contrast, real wages w_i are negotiated. By choosing the number of vacancies N_i, the firm maximizes the sum of the discounted future instantaneous profits $\pi_i(t)$ subject to equation (1). Instantaneous profits are total revenue minus labor costs and the costs of posting vacancies

$$\pi_i = p_i F_i(L_i) - w_i L_i - \gamma N_i, \quad i = X, Y.$$

The technology of a firm is given by $F_i(L_i)$ with $F_i'(L_i) > 0$, $F_i''(L_i) < 0$.

The current value Hamiltonian to solve this maximization problem reads $H = \pi_i + J_i \dot{L}_i$, where the multiplier J_i is the firms' evaluation of the marginal worker (Kamien and Schwartz, 1991). The equilibrium condition for the shadow price reads[2]

$$J_i = \frac{p_i F_i'(L_i) - w_i}{r + s}, \tag{2}$$

where J_i is the steady state evaluation of an additionally filled job. In the traditional models postulating perfectly competitive labor markets, employment is optimal if the value marginal product equals the wage rate. Hence, the static net value of a worker $p_i F_i'(L_i) - w_i$ becomes zero when employment is optimal. In the present model, the value of a marginal worker J_i will be positive as long as there are costs of posting a vacancy (cf. below).

A firm will offer a vacancy if the expected gains from the vacancy are greater than or equal to its expected costs. The former is given by J_i. Given vacancy costs γ and since the expected duration for a vacancy becoming matched is $N/m(\cdot)$, the expected costs for a vacancy are $\gamma N/m(\cdot)$. The free entry of vacancies ensures that there are as many vacancies so that the expected value of an additionally filled job equals the expected cost of posting it. Accordingly, the equilibrium version of the first–order condition also known as the "job creation condition" is given by

$$J_i = \gamma \frac{N}{m(\cdot)} \quad \text{with } N_i \geq 0. \tag{3}$$

Simplicity recommends employing a Cobb–Douglas specification of the matching function, i.e., $m(U, N) = AU^{\alpha}N^{1-\alpha}$. The parameter A has to be chosen such that the matches per unit of time neither exceed the number of vacancies nor of unemployed persons. The elasticity of the newly created matches with respect to the number of job seekers in the economy is denoted by α. Then, the job creation condition (3) modifies to

$$J_i = \gamma \theta^{\alpha}/A \Leftrightarrow \theta = \left(J_i A/\gamma\right)^{1/\alpha}. \tag{4}$$

Since it takes time for both the firm to find a worker and for the worker to find a firm, matched workers and firms have some monopoly rent stemming from the fact that they have already undergone a costly search process. For this reason, they bargain over the surplus of the match. Following the matching literature, the wage setting rule is the solution of an asymmetric Nash bargaining process. The unique real wage will maximize the weighted product of the worker's and firm's surplus of a match. In order to determine this rule, the employee's and the firm's surplus of the match have to be established.

A person can be employed in either sector X, sector Y or be unemployed so that the labor market accounting condition reads $\overline{L} = L_X + L_Y + U$. While employed, the worker earns a real wage w_i. When unemployed, the job seeker receives real unemployment benefits z. It is assumed that unemployment benefits are financed via a lump–sum tax so that they need not to be considered explicitly. Then, dynamic programming yields the asset value conditions. The equilibrium version for the unemployed person reads

$$rE_U = z + \frac{m(U,N)}{U}\left[\varepsilon\left(E_X - E_U\right) + \left(1-\varepsilon\right)\left(E_Y - E_U\right)\right], \tag{5}$$

where E_i stands for the return on being employed in sector i. The job seeker's permanent income rEU has to equal the sum of the unemployment benefits in terms of the numéraire and the "gain" from changing the employment status occurring with probability $m(\cdot)/U$. However, the latter only gives the probability of becoming matched in general. Given that the number of vacancies offered in sector i is N_i, the probability

of becoming matched to sector X can reasonably be defined as $\varepsilon m/U$, where $\varepsilon = N_X/N$. Accordingly, the probability of becoming matched to sector Y is given by $(1-\varepsilon)m/U$. A worker's return on being employed in sector i has to satisfy

$$rE_i = w_i + s(E_U - E_i) \tag{6}$$

in equilibrium. The interpretation is similar to the one given above.

A potential worker's surplus of the match can then be defined as the difference of the value of being employed in a specific sector E_i and the value of being unemployed E_U, i.e., $(E_i - E_U)$. The firm's value of an additionally hired worker is given by J_i. Hence, the wage which both partners will agree to has to maximize the Nash product $\Omega_i = (E_i - E_U)^{\beta} J_i^{1-\beta}$, where β denotes the bargaining power of an individual. Using the asset value conditions (5) and (6), the real wages are determined with

$$w_i = z + \beta(p_i F_i'(L_i) + \gamma\theta - z) \tag{7}$$

in equilibrium.[3] Here, the fact has been used that the value of an additional filled job has to be equalized in equilibrium according to equation (3). The wage setting rule shows that wages equal the real unemployment benefits z if individuals possess no bargaining power, i.e., if $\beta = 0$. For all other cases, individuals will earn wages higher than the unemployment benefits since the bracket term on the right hand side has to be positive. Otherwise, a rational individual would never agree to the proposed wage.

3. The Characterization of the Equilibrium

By introducing search frictions into the specific factors model, the system of equations characterizing the economy has to be modified. First, unemployment U has to be taken into consideration in the labor market condition. With equilibrium unemployment, we obtain a stock equilibrium condition

$$\overline{L} = L_X + L_Y + U. \tag{8}$$

Second, the usual equality between value marginal productivities and factor rewards is replaced by sectoral versions of Pissarides' job creation condition. Focusing on situations in which countries are incompletely specialized, employment in both sectors is strictly positive. As all variables stay constant over time in equilibrium, it follows from (1) that the number of vacancies in each sector N_i is strictly positive. Then, equation (3) or (4) imply that the number of vacancies in each sector are such that the value of an additionally filled job is equalized across sectors, $J_X = J_Y = J$. Using this fact in equation (2) leads to

$$(r+s)J = p_i F_i'(L_i) - w_i. \tag{9}$$

On the one hand, this equation shows that the value of an additionally filled job is solely determined by the marginal profit. On the other hand, it follows immediately that $p_X F_X'(L_X) - w_X = F_Y'(L_Y) - w_Y$, i.e., the marginal profits are identical in both sectors but, in contrast to the specific factors model, positive.

Third, a first additional equation resulting from wage bargaining is introduced in (7). Replacing the wage rate in (9) by (7) gives

$$p_X F_X'(L_X) = F_Y'(L_Y). \tag{10}$$

This condition determining the relative size of the sectors holds in static models as well and is justified by the argument that labor moves between sectors until the difference disappears. Here, the equalization of the value marginal products is a consequence of

the free entry of vacancies together with the fact that both sectors recruit from a common labor market. Therefore, if the value marginal product in one sector, say X, exceeds the one of the other sector Y the value of a job in sector X is higher than the one in sector Y. In this situation, no vacancies are offered in sector Y. Consequently, no unemployed person is matched to Y; and the relative size of this sector decreases until the value of a job again equalizes across sectors. With identical job values, the value marginal products and the wages are identical as well. As it can be seen in equation (7), identical value marginal products imply equal wage rates across sectors.

Using (4) to replace the value of an additionally filled job in (9) and noting that the wage rate is identical in both sectors in equilibrium, the modified job creation conditions for sector X and Y read

$$\begin{aligned} p_X F_X'(L_X) - w &= (r+s)\gamma\theta^{\alpha}/A, \\ F_Y'(L_Y) - w &= (r+s)\gamma\theta^{\alpha}/A. \end{aligned} \tag{11}$$

Finally, a second additional condition related to labor market flows is introduced. An equilibrium on the labor market is defined as a situation in which the unemployment level remains constant. Provided the labor force is constant, the number of newly matched job seekers $m(U, N)$ has to equal the number of persons entering the unemployment pool $s(L_X + L_Y)$. Using the Cobb–Douglas specification of the matching function, the equilibrium condition is

$$A(\overline{L} - L_X - L_Y)\theta^{1-\alpha} = s(L_X + L_X). \tag{12}$$

This condition establishes an important link between total employment $L_X + L_Y$ and the labor market tightness parameter θ (and by (4) the value of a job J). Employment rises if and only if the value of a job and the Beveridge ratio rises. This will turn out to be a key relationship in the model.

The system of equations fully determining the equilibrium of the economy is formed by (7), (11), and (12). This system determines the wage rate w, the sectoral employment L_i and the measure of the labor market tightness θ. The remaining variables, the value of an additionally filled job J, the level of unemployment U and number of vacancies N readily follow from equation (4), the labor market accounting condition (8) and the definition of $\theta = N/U$.

4. The Effects of Relative Price Changes

General Results

Let us summarize the results before giving an interpretation. First, the sector expands if its relative output price rises and if the relative output price of the other sector becomes smaller,

$$\frac{dL_X}{dp_X} > 0, \quad \frac{dL_Y}{dp_X} < 0. \tag{13}$$

Second, a relative increase in the world market prices of sector X results in an increase of the Beveridge ratio θ and the value of an additionally filled job J, whereas the level of unemployment decreases:

$$\frac{d\theta}{dp_X} > 0, \quad \frac{dJ}{dp_X} > 0, \quad \frac{dU}{dp_X} < 0. \tag{14}$$

Finally, there is a positive correlation between real wages and the relative product price p_X,

$$\frac{dw}{dp_X} > 0. \tag{15}$$

The mechanism behind these relations is illustrated for a decrease in the relative price of industry X. The employment effects in (13) and the wage effect in (15) are qualitatively the same as in the standard specific factors model with a perfectly competitive labor market (Ethier, 1988). The intuition within the latter framework is that if the relative price of good X falls the value marginal product in sector Y (and therefore the wages in that sector) exceeds the one in sector X. Perfect mobility of individuals between sectors induces workers to leave sector X. This process continues until the value marginal product and wages are equalized again, but at a lower level.

When introducing search frictions into a specific factors model, the reallocation effect is still present. However, the way by which it is achieved is different. In the present model, a reduction of the relative price of X directly affects the job creation condition (11) for sector X. Immediately after the shock occurs, the value of an additionally filled job J and wages w still take their pre–shock values. Yet, the value marginal product in sector X is lower so that the job creation condition (11) is violated. Consequently, sector X does not post any vacancies. This has two consequences. On the one hand, workers are no longer matched to sector X so that this sector shrinks. On the other hand, the total number of vacancies decreases, thereby increasing the probability for each vacancy of sector Y to become matched. Hence, the expected costs for offering vacancies in sector Y decreases. This leads to additional vacancy offers and sector Y expands.

In addition to the reallocation effect, relations (14) show that there is also an employment effect. Due to the drop of the relative price of X, total employment falls. This effect does not exist in a standard specific factors model. Clearly, the total employment effect is the sum of the sectoral employment effects. According to (17) in the appendix, the decrease of the employment in X due to a drop in the relative price of this sector has two components. The first term is the normal reallocation effect since it is exactly balanced by the increase of employment in sector Y (cf. (18)). Hence, the second term causes total employment to fall as can be verified in (20).

Equation (20) also gives a hint as to the reason for the total employment effect. If the firms had no bargaining power, i.e., if $\beta = 1$, a decrease in the relative price of X would have no effect on total employment. Indeed, the indirect effect of a change in the relative product prices works through wages. The reallocation effect induces sector Y to grow. As a consequence, the value marginal product of that sector decreases. The wage equation (7) implies that wages fall in response to the lower value marginal product. Yet, the wage reduction is lower as compared to the decrease in the value marginal product as long as the firms have some bargaining power. The reason for the 'insufficient' wage reaction lies in the fact that the common surplus of a match (the bracket term on the right–hand side of (7)) falls as the value marginal product decreases and because vacancy costs and unemployment benefits are measured in units of the numéraire. As usual in bargaining problems, both negotiation partners share the gains and the losses according to their bargaining power. Hence, if the bargaining power is entirely held by workers, i.e., if $\beta = 1$, they appropriate the entire common surplus of the match *and* bear the burden of the shrinking surplus alone.

For $\beta = 1$, the relevant equations describing the firms' choice would be independent of the relative product price p_X. Indeed, the modified job creation condition (16) in the

appendix does not depend on p_X when $\beta = 1$. Then, both the Beveridge ratio θ and the value of an additionally filled job J are not affected by relative price changes. Since these variables are the crucial factors in deciding on the number of vacancies offered, firms' incentives to create vacancies are not altered when relative prices vary *and* the bargaining power is entirely with the workers. Although total employment does not change in that case, it has a lower level than for $0 < \beta < 1$.

In our case, where each negotiation partner has some bargaining power, $0 < \beta < 1$, a decrease in p_X implies a decline in the surplus of a match and, therefore, fewer vacancies and higher unemployment. These results imply that the equilibrium is characterized by a positive correlation between wages and employment. In a non–causal sense, higher wages are associated with higher employment. This results from the fact that the value of a job, the number of vacancies and wages increase as the value marginal product of labor increases. As an (de-)increase the relative product price p_X (de-)increases the value marginal product of labor, wages and employment are positively correlated.

Neoclassical Ambiguity and Terms-of-Trade Changes

In a Heckscher–Ohlin–Samuelson framework, the Stolper–Samuelson Theorem asserts that an increase in the relative price raises the real return of the factor used more intensively in the production of that commodity. Hence, the real wage deceases due to a drop in the relative price p_X only if sector X uses labor more intensively in production. This result is independent of the choice of the numéraire. In the standard specific factors model, the decrease of the relative price p_X yields an ambiguous result for the real wage (Jones and Neary, 1984). It depends on which good is the numéraire.

In the present model, we find a similar result. The real wage w in terms of the numéraire Y is an increasing function of the relative price p_X independent of which commodity uses labor more intensively in production (cf. (15)). The real wage in terms of good X does not necessarily increase as the reactive price p_X falls. To see this, let $\overline{w}$, $\overline{w} = w/p_X$, be the real wage in terms of commodity X. Then, a change in the relative price p_X affects the real wage $\overline{w}$ according to

$$\frac{d\overline{w}}{dp_X} = -\frac{1}{p_{X^2}} w + \frac{1}{p_X} \frac{dw}{dp_X}.$$

The first term on the right hand side is negative while the latter is positive. Unfortunately, it is not clear whether the price effect dominates the second one so that the real wage in terms of X may rise or fall as the relative price p_X decreases. However, the sign of $d\overline{w}/dp_X$ is independent of whether or not the production of X is relatively labor intensive.

It has been demonstrated above that a drop of the relative price p_X increases the unemployment level. This result is independent of whether sector X or Y uses labor more intensively in production and whether commodity X or Y is exported. Unemployment rises as p_X falls whether the terms-of-trade deteriorate (export of X) or improve (export of Y). This property is a consequence of the neoclassical ambiguity of the standard specific factors model. In the latter model, the decrease of the nominal wage is smaller than the drop of the relative price of p_X independent of which good is exported. In the present model, the real rigidities in γ and z (and hence individual bargaining structure) causes wages to respond insufficiently to a decrease in p_X. It can, therefore, be expected that unemployment can rise both for a deterioration and an improvement of the terms of trade.

Given the short- to medium–run perspective for the present specific factors model, other factors can be viewed to be mobile in the long–run. Then, we can fix our good X to be the labor intensive one which allows us to make statements about old and new member states of the EU. Assuming new member states to be more labor abundant, the relative price of good X should fall in old member states, but it should rise in new member states. As already mentioned in the introduction, EU enlargement of May 2004 should not only reduce the equilibrium wage in old member states—at least, as just discussed, when measured in units of the numéraire good Y—but also increase unemployment. While the standard labor–demand increasing effect of lower wages does hold in our model, low wages can be associated with high unemployment and vice versa.[4]

5. Conclusion

The present paper studied the effects of a relative price change on sectoral employment, total unemployment and wages in a small open economy. A decrease in the relative world market price leads to a decrease in wages and an increase in the unemployment rate. A drop of the relative product price of good X implies an expansion of sector Y and a shrinking of sector X. Firing in the shrinking sector exceed hiring in the expanding sector since the firms' return on the marginal employee (the value of a job) decreases as the relative price of the good falls. Therefore, they offer fewer vacancies and unemployment rises.

Workers gain and lose in the same way as firms do. Increases in the value marginal product raise the surplus of a worker–firm match and thereby the bargained wage. Wages and the value of a job, and therefore the employment level, are positively correlated. High wages are associated with high employment and low wages with low employment. If workers hold all of the bargaining power, the employment effect of relative price changes vanish. All price changes are then translated into wage changes and the value of a job becomes independent of the value of the relative product prices. In this case, total employment is independent of the international price ratio. In general, however, unemployment levels are the higher, the higher bargaining power of workers is.

We found the reallocation effect and the wage effect as expected from a standard specific factors model. As compared to the latter model, the employment effect is new. It is a consequence of the individual bargaining structure, which is a logical consequence of search and matching processes that generate rents.

In contributions focusing on Heckscher–Ohlin–Samuelson models with imperfect labor markets, as, e.g., the ones of Brecher (1974, 1992) and Hoon (1991), employment may also fall as a consequence of the terms-of-trade changes. In the present as well as in those models, the downward inflexibility of wages is the reason for the employment effect. Moreover, in our model, unemployment increases whether a drop in the relative product price is associated with a deterioration or an improvement of the terms-of-trade. This feature sets itself apart from the Heckscher–Ohlin–Samuelson based ones. An additional feature of the present model is that it establishes a link between changes on the world markets and the Beveridge ratio which is an important measure of the domestic labor market tightness.

Returning to the EU enlargement perspective of May 2004, our paper unfortunately does not draw a bright picture for old member states. When new member states are relatively labor rich, wages in old member states should go down while at the same time unemployment goes up. This holds at least for the short- and medium–run for

which this model is designed. Things might look better in the long–run. The predictions are much better for new member states. Wages in these countries should increase while unemployment goes down.

Appendix

The Effects of Relative Price Changes (Deriving (13) and (14))

To determine the effects of relative product price variations on the economy, it is convenient to reduce the system of equations formed by (7), (11), and (12) further. From the equations given in (11) immediately follows equation (10). Inserting the equilibrium version of (7), where wages are identical in both sectors, into the job creation condition for sector Y leads to

$$(1-\beta)[F_Y'(L_Y)-z]=(r+s)\gamma\theta^{\alpha}/A+\beta\gamma\theta, \tag{16}$$

which is just the modified job creation condition for sector Y. Then, the job creation condition for sector X is implicitly given via the uniformity of the value marginal product. Using this equation together with (10) and (12) ensues in the following system of equations:

$$\begin{aligned}
&p_X F_X'(L_X)-F_Y'(L_Y)=0\\
&(1-\beta)[F_Y'(L_Y)-z]-(r+s)\frac{\gamma}{A}\theta^{\alpha}-\beta\gamma\theta=0\\
&A(\overline{L}-L_X-L_Y)\theta^{1-\alpha}-s(L_X+L_X)=0.
\end{aligned}$$

The linearized system reads

$$\begin{bmatrix} p_X F_X'' & -F_Y'' & 0\\ 0 & (1-\beta)F_Y'' & -G_{23}\\ -G_{31} & -G_{31} & G_{33}\end{bmatrix}\begin{bmatrix} dL_X\\ dL_Y\\ d\theta\end{bmatrix}=\begin{bmatrix} -F_X' dp_X\\ 0\\ 0\end{bmatrix},$$

where

$$\begin{aligned}
&G_{23}=\alpha(r+s)\gamma\theta^{\alpha-1}/A+\beta\gamma>0\\
&G_{31}=A\theta^{1-\alpha}+s>0,\quad G_{33}=(1-\alpha)U\theta^{-\alpha}>0,\quad U=\overline{L}-L_X-L_Y.
\end{aligned}$$

The determinant is

$$\Delta=(1-\beta)p_X F_X'' F_Y'' G_{33}-(p_X F_X''+F_Y'')G_{23}G_{31}>0,$$

and the derivatives are

$$\frac{dL_Y}{dp_X}=F_X'[G_{23}G_{31}-(1-\beta)F_Y''G_{33}]\Delta^{-1}>0, \tag{17}$$

$$\frac{dL_Y}{dp_X}=-F_X'G_{23}G_{31}\Delta^{-1}<0, \tag{18}$$

$$\frac{d\theta}{dp_X}=-(1-\beta)F_X'F_Y''G_{31}\Delta^{-1}>0. \tag{19}$$

Using the labor market accounting condition, we find

$$\frac{dU}{dp_X}=-\frac{dL_X}{dp_X}-\frac{dL_Y}{dp_X}=\frac{1}{\Delta}(1-\beta)F_X'F_Y''G_{33}<0. \tag{20}$$

From the wage equation (7) follows that

$$\frac{dw}{dpx} = \beta F_Y'' \frac{dL_Y}{dp_X} + \beta\gamma \frac{d\theta}{dp_X} > 0. \tag{21}$$

Finally, by equation (4), the value of an additionally filled job changes with the relative prices according to

$$\frac{dJ}{dp_X} = \alpha \frac{\gamma}{A} \theta^{\alpha-1} \frac{d\theta}{dp_X} > 0. \tag{22}$$

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Notes

1. To shorten notation, we will frequently use p_i. When i stands for sector X, p_X is the relative price of sector X; p_i equals one when i denotes sector Y.
2. In order to keep the model tractable, we follow Pissarides (2000, ch. 3) and assume that firms neglect the effect of the marginal worker on negotiated wages.
3. Due to the fact that the model economy has two sectors, the relative price of good X explicitly enters the wage setting rule. This is the only difference to the equivalent wage equation in the standard Pissarides (2000) model.
4. This effect and the importance of the choice of the numériare, i.e., price deflator, should be taken into account when analyzing the enlargement effects econometrically.