UNEMPLOYMENT OF SKILLED AND UNSKILLED LABOR

IN AN OPEN ECONOMY:

INTERNATIONAL TRADE, MIGRATION AND OUTSOURCING

Richard A. Brecher and Zhiqi Chen*

Department of Economics
Carleton University
1125 Colonel By Drive
Ottawa ON K1S 5B6
Canada

September 2008
Revised August 2009

Abstract

We show how international trade, migration and outsourcing affect unemployment of skilled and unskilled labor, in a framework that integrates the Heckscher-Ohlin model of trade with the Shapiro-Stiglitz model of unemployment. Our approach allows us to analyze changes in not only aggregate unemployment, but also the distribution of unemployment between skilled and unskilled labor. As the analysis demonstrates, the unemployment rates of these two types of labor often move in opposite directions, thereby dampening the change in aggregate unemployment. Results depend on the source of comparative advantage, based on international differences in (for example) unemployment insurance or production technology.

Key Words: Open-Economy Unemployment; Trade; Migration; Outsourcing

JEL Codes: F11, F16, F22

* For helpful comments and suggestions, we thank Ehsan U. Choudhri, Hian Teck Hoon, Adrian Wood, Ting Zhang and seminar participants at University of Manitoba and University of Waterloo. Chen's research was financially supported by the Social Sciences and Humanities Research Council of Canada.

1. Introduction

Unemployment effects of economic globalization figure prominently in policy debates about international trade, migration and outsourcing. Nevertheless, these effects are neglected in most of the related theory, which is predominantly in the full-employment tradition. In defence of this neglect, some theorists argue that the long-run (natural) rate of unemployment is analytically independent of international exchange in goods and services,[1] while others reason that any globalization-induced change in the total number of jobs is likely to be empirically insignificant.[2] The first of these defences is unconvincing, in light of known results from existing models of unemployment in open economies;[3] and the second ignores the fact that even a negligible change in the aggregate number of jobs can be accompanied by a socially serious adjustment in the unemployment distribution between different types of workers.[4]

In the context of this distributional problem, the present objective is to investigate the unemployment effects of international trade, migration and outsourcing within a single framework. To do so, we integrate the standard (two-country two-good two-factor) model of international trade with the Shapiro-Stiglitz (1984) model of efficiency-wage unemployment. A distinguishing feature of our approach is that the two factors of production—skilled and unskilled labor—are *both* subject to involuntary

---

[1] For this type of argument, see Krugman (1993) and Mussa (1993).
[2] This line of reasoning is used by Bhagwati, Panagariya and Srinivasan (2004).
[3] For instance, see Brecher (1974a, 1974b, 1992), Brecher and Choudhri (1987), Copeland (1989), Davidson, Martin and Matusz (1999), Davidson, Matusz and Schevchenko (2008), Davis (1998), Hoon (2000), Mitra and Ranjan (2007), and Zhang (2008, chaps. 6-8).
[4] As Davidson and Matusz (2002, p. 4) suggest, moreover, further empirical work is needed to determine globalization's impact on the aggregate rate of unemployment.

unemployment.[5] Thus, our model allows us to analyze changes in not only the total number of jobless workers, but also the distribution of unemployment between skilled and unskilled labor. Indeed, a recurring theme of the present paper is that the unemployment rates of these two types of labor often move in opposite directions, implying an ambiguous direction of change in aggregate unemployment. Consequently, a small change in the total number of jobs might mask significant swings in the unemployment rates for skilled and unskilled labor.

Our analysis provides insight on how national labor-market institutions can affect global patterns of trade, unemployment and wages. Specifically, we demonstrate that an international difference in unemployment benefits can be a source of comparative advantage, leading the country with more generous benefits for (say) unskilled labor to import the good that uses this labor intensively in production. Surprisingly, despite international equalization of prices and wages, trade in this case causes the unemployment rate for unskilled labor to diverge between countries. Furthermore, a national improvement in unemployment benefits for one type of labor, while unambiguously raising the corresponding rate of unemployment if the economy is closed, might paradoxically reduce this rate when the economy is open to trade.

The present analysis also sheds light on the unemployment effects of international migration and outsourcing. Both types of factor movement entail the use of one country's labor in the other country's production. However, unlike migration,

---

[5] The empirical relevance of this feature is clear from Nickell and Bell's (1995) estimates, which indicate that changes in factor-specific rates of unemployment are an important aspect of the rise in labor-market inequality between skilled and unskilled workers within developed countries. For a discussion of this rise in the context of the full-employment version of the Heckscher-Ohlin model, see Wood (1995), for example.

outsourcing involves no physical movement of workers across national borders.[6] In a model of full employment, migration and outsourcing (as defined here) are analytically equivalent because what matters is the matching of one country's production with the other country's labor, rather than the location of the matching. On the other hand, in our model, the two types of labor mobility differ in the following important way: although outsourcing merely *transfers* employment from one country's production to another's, migration from a country with a relatively high rate of unemployment also causes world employment to *expand*.

Interestingly, the consequences of this employment transfer and employment expansion depend on the underlying reasons for international trade. In the case where trade is caused by an international difference in unemployment benefits for unskilled labor, migration causes the unemployment (wage) rate of unskilled labor to rise (fall) in both countries, with exactly the opposite consequences for skilled labor. However, outsourcing of unskilled labor in this case does not have any effect on unemployment and wage rates.

On the other hand, in the case where trade is caused by an international difference in technology, both migration and outsourcing affect unemployment and wage rates in the two countries. In particular, contrary to conventional wisdom, each type of factor movement can (under specified conditions) reduce the unemployment rate and raise the wage rate of the mobile factor in both countries.

---

[6] This notion of outsourcing is consistent with Bhagwati, Panagariya and Srinivasan (2004) who define outsourcing as mode 1 trade (i.e., cross-border supply) of services. See the same article for a discussion about why other definitions of outsourcing (e.g., trade in intermediate goods) are not appropriate.

Section 2 presents our basic model. The effects of unemployment insurance are analyzed in section 3, while causes and consequences of trade are considered in section 4. Migration and outsourcing are examined in section 5 for the case of an international difference in unemployment benefits, and in section 6 for a difference in production technology. Section 7 concludes.

2. Basic Model

The economy is competitive and free from externalities. There are two consumer goods, X and Y, both internationally tradable. These goods are produced by profit-maximizing firms that use homogeneous inputs 1 and 2, which respectively are unskilled and skilled labor. Each type of labor has a propensity to shirk, and hence suffers from unemployment, because firms (with imperfect monitoring) keep wages above the full-employment levels to maintain effort. Infinitely-lived workers maximize the expected value of life-time utility, in the absence of borrowing and lending.

2.1. *No-Shirking Constraint*

The heart of the Shapiro-Stiglitz (1984) model is their no-shirking constraint, which we now generalize to allow for a second good and unemployment of a second input. The key to our generalization is a straightforward extension of their utility function.

For this purpose, instantaneous utility is now given by $U(c_i^X, c_i^Y) - e_i$ for a worker who supplies input i (= 1, 2); where c_i^X and c_i^Y are the worker's consumption levels of goods X and Y; e_i is the effort provided by the worker; while function U (the same for

both types of workers)[7] is increasing in each argument and strictly quasi-concave. For an unemployed worker or employed shirker, $e_i = 0$; whereas a nonshirking employee has a constant $e_i = \bar{e}_i > 0$.

On the assumption that function U is homogeneous of degree 1, individual optimization over the two consumption goods implies that instantaneous utility of a type-*i* worker can be represented by $m_i / \gamma(p) - e_i$; where m_i denotes this worker's expenditure in terms of good Y; p represents the relative price of good X in terms of Y; and γ is the unit-expenditure function, a true cost-of-living index. By Roy's identity, we can write the worker's demand for good X as:

$$c_i^X = m_i \gamma'(p) / \gamma(p), \quad i = 1, 2 . \tag{1}$$

This implies that the worker's demand for good Y is $c_i^Y = m_i[\gamma(p) - p\gamma'(p)] / \gamma(p)$. Positive demands for both goods imply that $0 < \gamma' < \gamma / p$.

Since borrowing and lending are absent from the model, m_i equals $w_i - \tau_i$ or $\bar{w}_i - \tau_i$ if the worker is employed or unemployed, respectively; where w_i, $\bar{w}_i$ and τ_i denote the real wage, unemployment benefit and (factor-specific) head tax, respectively, all expressed in terms of good Y. Thus, except for the presence of index *i* (to distinguish inputs), γ (to deflate expenditure) and τ_i (to finance the unemployment benefit), our specification of utility—namely, $(w_i - \tau_i) / \gamma(p) - \bar{e}_i$ or $(\bar{w}_i - \tau_i) / \gamma(p)$ for an employed or unemployed worker, respectively—is essentially the same as the one adopted by Shapiro and Stiglitz (1984).

---

[7] For complications arising when utility functions differ between classes of consumers, see Johnson (1959) and Kenen (1959).

Therefore, by repetition of the Shapiro-Stiglitz (1984) derivation *mutatis mutandis*, their no-shirking constraint (11) becomes $(w_i - \tau_i)/\gamma(p) \geq (\overline{w}_i - \tau_i)/\gamma(p) + \overline{e}_i[1 + (b_i / u_i + r_i)/q_i]$, which simplifies to

$$w_i \geq \overline{w}_i + \overline{e}_i[1 + (b_i / u_i + r_i)/q_i]\gamma(p), \quad i = 1, 2, \tag{2}$$

where u_i is the unemployment rate for input *i*; b_i represents the fixed probability of being separated from a job exogenously (for reasons other than shirking) per unit time; r_i denotes the constant rate of time preference; and q_i stands for the fixed probability of being detected (and hence fired for) shirking per unit time. (Thus, $b_i + q_i$ is a shirker's overall probability of job loss.) The right-hand side of (2) represents the no-shirking wage, which is the lowest value of w_i consistent with provision of effort. At this wage, workers are indifferent between shirking and not shirking, and hence (by convention) choose not to withhold effort.[8]

2.2. *Price-Unemployment Relationship*

On the assumptions that technology is neoclassical (characterized by positive but diminishing marginal products, constant returns to scale and the Inada conditions), that production remains diversified and that goods X and Y are relatively intensive in inputs 1 and 2, respectively,

$$w_i = \omega_i(p), \; i = 1, \; 2, \tag{3}$$

[8] We follow Shapiro and Stiglitz in restricting attention to steady states. Kimball (1994) extends their (closed-economy) model to analyze labor-market dynamics outside steady state—as do Brecher, Chen and Choudhri (2002, 2009) who further generalize the model to allow for savings.

by Samuelson's (1949) one-to-one correspondence between product and factor prices; where ω_i gives the marginal product of input *i* in industry Y, as a function of the goods-price ratio. We also have $\omega_1' > 0 > \omega_2'$ by the Stolper-Samuelson (1941) theorem, and $p\omega_1' / \omega_1 > 1$ in accordance with the magnification effect of Jones (1965).

Substitute (3) into (2)—using the binding version of this constraint because firms will not pay more than the no-shirking wage—and obtain

$$\omega_i(p) = \overline{w}_i + \overline{e}_i[1 + (b_i / u_i + r_i) / q_i]\gamma(p), \quad i = 1, 2. \tag{4}$$

This equation provides a key relationship between the unemployment rate and the product-price ratio, given the underlying parameters ($\overline{w}_i$, $\overline{e}_i$, b_i, r_i and q_i).[9] Suppressing all but one of these parameters, write this functional relationship as $\tilde{u}^i(p; \overline{w}_i)$, which gives the value of u_i.

It is easy to see from (4) that $\tilde{u}^i_w > 0$, where subscripts of functions denote partial derivatives (e.g., $\tilde{u}^i_w \equiv \partial\tilde{u}^i / \partial\overline{w}_i$). Intuitively, a rise in unemployment benefits for a type of labor tends to increase its no-shirking wage above the marginal product at constant prices, thereby requiring an offsetting rise in the corresponding rate of unemployment.

To investigate the price-unemployment relationship, differentiate (4) to obtain

$$\tilde{u}^i_p = (p\gamma' / \gamma - p\omega_i' / \omega_i)\omega_i q_i u_i^2 / (p\gamma\overline{e}_i b_i), \quad i = 1, 2. \tag{5}$$

Recalling that $p\gamma' / \gamma < 1 < p\omega_1' / \omega_1$ and $\omega_2' < 0 < \gamma'$, note that (5) implies $\tilde{u}^1_p < 0 < \tilde{u}^2_p$. In other words, if there is an increase in the relative price of the good that intensively uses unskilled labor, this input enjoys a decrease in its rate of unemployment, while skilled

[9] Hoon (2000, chap. 4) derives a similar relationship, assuming a Cobb-Douglas utility function and no unemployment insurance, in a model where only one of the inputs is less than fully employed.

labor suffers an increase in unemployment. These labor-market changes are needed to maintain equality between each input's no-shirking wage and marginal product, which is affected by the price change.

The corresponding change in the aggregate rate of unemployment is $\alpha_1 \tilde{u}_p^1 + \alpha_2 \tilde{u}_p^2$; where $\alpha_i \equiv \bar{L}_i / (\bar{L}_1 + \bar{L}_2)$ for $i = 1,\ 2$; and $\bar{L}_i$ is the fixed (but partially unemployed) endowment of input *i*. Clearly, this aggregate change can be positive, zero or negative, because $\tilde{u}_p^1$ and $\tilde{u}_p^2$ differ from each other in sign (and are not functions of α_i). Thus, small adjustments in the observed rate of aggregate unemployment might mask pronounced changes in rates of skilled and unskilled unemployment.[10]

2.3. *Product-Market Equilibrium*

For the sake of concreteness, suppose that the home country has a comparative advantage in good Y. Although the possible sources of this advantage need not concern us at the present stage in the discussion, they will require attention later in the paper.

Assume that the government balances a separate budget for workers of each type *i*, by using head-tax revenues $\tau_i \bar{L}_i$ to finance unemployment benefits $\bar{w}_i u_i \bar{L}_i$.[11] Thus,

$$\tau_i = \bar{w}_i u_i, \quad i = 1, 2. \tag{6}$$

[10] An increase in p causes not only a fall in u_1 and rise in u_2, but also (by the Stolper-Samuelson theorem) a rise in w_1 and fall in w_2. Thus, $w_1(1-u_1)\bar{L}_1 / w_2(1-u_2)\bar{L}_2$ increases, indicating that the distribution of wage income shifts in favor of unskilled (at the expense of skilled) labor. The magnitude of this shift is greater than in the full-employment version of the Heckscher-Ohlin model, which would have the same change in w_1 / w_2 but a constant (unitary) value of $(1-u_1)/(1-u_2)$.

[11] We could relax this separate-budget assumption, at the expense of complicating the exposition, without significantly affecting our results.

To find an expression for the home demand for imports of good X, first use (1), (3) and (6) to write the aggregate demand for X in the home country as follows:

$C^X = \sum_{i=1}^{2} w_i(1-u_i)\overline{L_i}\gamma'(p)/\gamma(p) = \sum_{i=1}^{2} \omega_i(p)\tilde{L}^i(p;\overline{w}_i)\gamma'(p)/\gamma(p)$, where

$\tilde{L}^i(p;\overline{w}_i) \equiv [1-\tilde{u}^i(p;\overline{w}_i)]\overline{L}_i = L_i$, which denotes the employment level of input *i* (= 1, 2); and given (5), $\tilde{L}^1_p > 0 > \tilde{L}^2_p$ while (for each *i*) $\tilde{L}^i_w < 0$. Next, output of good X is given by $Q^X[p, \tilde{L}^1(p;\overline{w}_1), \tilde{L}^2(p;\overline{w}_2)]$ along the production-possibility frontier.[12] Then, we can express the import demand for good X, $C^X - Q^X$, in the form of function $M[p, \tilde{L}^1(p;\overline{w}_1), \tilde{L}^2(p;\overline{w}_2)]$.

As in most of the full-employment literature, assume that $M_p < 0$. In accordance with Kemp's (1969, pp. 104-111) analysis, the partial derivatives of M with respect to L_1 and L_2 satisfy the conditions $M_1 < 0 < M_2$. That is, if total employment of a single input rises with product prices held constant, there is a corresponding decrease (increase) in excess demand for the good that uses this input intensively (non-intensively).

Foreign exports of good X can be expressed similarly as a function of p^*, $\tilde{L}^{1*}(p^*;\overline{w}^*_1)$ and $\tilde{L}^{2*}(p^*;\overline{w}^*_2)$; where asterisks indicate foreign counterparts of home symbols. However, it is sufficient (for present purposes) to represent these exports more compactly by the reduced-form function $E(p^*)$, after suppressing foreign unemployment benefits.

To clear the world market for good X, with $p = p^*$ because of free trade, we need

[12] This frontier is determined (as usual) by technology and aggregate employment levels, but is now shifted by product-price changes, which cause adjustments in L_1 and L_2.

$$M[p, \tilde{L}^1(p;\overline{w}_1), \tilde{L}^2(p;\overline{w}_2)] = E(p). \tag{7}$$

This condition also implies market clearing for good Y, in light of Walras' law. Assume that $\Delta \equiv M_p + M_1\tilde{L}^1_p + M_2\tilde{L}^2_p - E' < 0$, to ensure that the world's excess demand ($M - E$) for good X falls when the relative price of X rises. This assumption guarantees (Walrasian) stability and uniqueness of equilibrium.

3. Effects of Unemployment Insurance

It is a common belief among economists that more generous unemployment benefits tend to increase the unemployment rate. However, our analysis below shows that, when countries trade with each other, this view is not necessarily correct.

To be specific, consider an increase in unemployment insurance for input 1 in the home country.[13] Thus, differentiate (7) totally with respect to $\overline{w}_1$, and find that

$$dp / d\overline{w}_1 = -M_1\tilde{L}^1_w / \Delta > 0, \tag{8}$$

because all three terms on the right-hand side of equation (8) are negative. Thus, recalling that $\tilde{u}^2_p > 0 > \tilde{u}^1_p$, we have the following two results. First, the value of L_2 unambiguously falls (because u_2 rises) in response to the increase in $\overline{w}_1$. Second, the value of L_1 can rise or fall—depending on whether the positive impact of the increase in p is stronger or weaker than the directly negative effect of the enhancement of unemployment insurance—as we now show.

[13] An increase in $\overline{e}_1$, b_1, r_1 or decrease in q_1 would have effects similar to those derived in the present section for a rise in $\overline{w}_1$.

The change in employment of the first input is $dL_1 / d\overline{w}_1 = \tilde{L}_p^1 dp / d\overline{w}_1 + \tilde{L}_w^1$. Into this equation, substitute (8) and obtain

$$dL_1 / d\overline{w}_1 = (1 - M_1 \tilde{L}_p^1 / \Delta)\tilde{L}_w^1 . \tag{9}$$

If $E' > 0$—i.e., foreign demand for imports (of good Y) is elastic with respect to relative price $(1/p)$—then $M_1 \tilde{L}_p^1 / \Delta < 1$, in which case $dL_1 / d\overline{w}_1 < 0$ by (9).[14] However, if instead $E' < 0$—indicating an inelastic demand for imports by the foreign country—it is possible to have $M_1 \tilde{L}_p^1 / \Delta > 1$, implying that $dL_1 / d\overline{w}_1 > 0$.

If the economy were closed, we would have $E \equiv E' \equiv 0$ and consequently $M_1 \tilde{L}_p^1 / \Delta < 1$. Then, (9) would imply that $dL_1 / d\overline{w}_1 < 0$. Therefore, more generous unemployment benefits for an input would always reduce the employment level of that input if international trade were absent, although the opposite may be true in the presence of trade.

Employment abroad is also affected by an enhancement in unemployment insurance at home, because of the enhancement-induced change in the terms of trade. Specifically, the foreign counterpart of (5) implies that L_1^* rises while L_2^* falls, with the net effect on aggregate employment being ambiguous in sign. In other words, the foreign country may experience an aggregate employment gain or loss as a result of the more generous unemployment benefits in the home country.

---

[14] As E' (and hence Δ) $\to 0$, $dL_1 / d\overline{w}_1 \to \tilde{L}_w^1$ (> 0), representing the limiting case in which the home country is a small open economy.

4. Causes and Consequences of Trade

In our model, world trade can arise for a variety of reasons, including familiar ones like international differences in factor endowments ($\overline{L}_i$) or production technology. More specific to the unemployment dimension of our model, differences in $b_i, \overline{e}_i, q_i$ and $\overline{w}_i$ can also be causes of trade.

This section focuses on the case in which a difference in unemployment benefits leads to trade. Suppose that the two countries are identical in all aspects except that $\overline{w}_1 > \overline{w}_1^*$. In free trade, the home country imports good X that is intensive in unskilled labor (input 1), as the following analysis shows.

As usual, it is helpful to consider first the case of autarky. The autarkic equilibrium price in the home country is determined by (7) with $E(p) \equiv 0$. Then, (8) implies that $p > p^*$ in autarky. Given its higher autarkic relative price of good X, the home country will import this good when trade is allowed to occur.

With each country producing both goods in free-trade equilibrium (where $p = p^*$), (3) implies that $w_i = w_i^*$ for i = 1, 2. That is, free trade leads to international factor-price equalization (as in the standard full-employment version of the Heckscher-Ohlin model). Then, from (4), $u_1 > u_1^*$ (given that $\overline{w}_1 > \overline{w}_1^*$) but $u_2 = u_2^*$. In other words, the unemployment rate for unskilled workers is higher in the country that offers them more generous unemployment benefits. The higher unemployment rate and more generous benefits imply a greater tax burden in the home country; that is, $\tau_1 > \tau_1^*$ in light of (6).

Consequently, while unskilled employees in the two countries earn the same wage before tax, their after-tax wages differ, with $w_1 - \tau_1 < w_1^* - \tau_1^*$.

When the world moves from autarkic to free-trade equilibrium, p falls to equal the rising p^*. Thus, from (5) and its foreign counterpart, the home rate of unemployment increases for unskilled labor but decreases for skilled labor, while the opposite changes occur abroad. In this way, trade causes the unemployment rates of unskilled (skilled) labor to diverge (converge) internationally. The effects of trade on the aggregate rates of unemployment, however, are ambiguous.

5. Migration versus Outsourcing Induced by Differences in Unemployment Benefits

This section and the next one compare the effects of introducing labor migration versus outsourcing, starting from a position of free trade in goods. As discussed above, international trade in our model may arise for a variety of reasons. Accordingly, the effects of migration or outsourcing depend on the underlying reasons for trade. This section analyzes migration and outsourcing when trade is caused by an international difference in unemployment benefits. The next section redoes the analysis for the case where trade arises because of differences in production technology.[15] With these two cases, we intend to capture salient aspects of migration and outsourcing activities among developed countries (section 5), as well as between developed and developing countries (section 6).

[15] Endowment differences are not considered here, because they would not create any incentive for migration or outsourcing, given free trade in goods.

5.1. Migration

Assume that when migrating to a different country, a worker initially enters the unemployment pool there. In deciding whether to migrate, the worker calculates the migration-induced change in expected life-time utility. If an unemployed worker does not find it beneficial to migrate, neither will an employed worker, since the latter's life-time utility is higher than the former's. In other words, an incentive to migrate exists only if an unemployed worker can gain from moving. Therefore, to determine the incentives to migrate, it is sufficient to compare an unemployed worker's expected life-time utilities in the two countries.

Continue to assume that the two countries are identical in all aspects, except that $\bar{w}_1 > \bar{w}_1^*$. To ascertain whether there is any incentive to migrate, rewrite the no-shirking constraint (2) in the following equivalent form, which generalizes Shapiro and Stiglitz's (1984) condition (5) in an obvious manner (to accommodate our γ, i and τ_i):

$$(w_i - \tau_i)/\gamma \geq r_i V_i^u + (r_i + b_i + q_i)\bar{e}_i / q_i, \quad i = 1, 2, \tag{10}$$

where V_i^u represents the expected life-time utility of an unemployed worker. Since constraint (10) is binding in equilibrium, we can rearrange it to solve for

$$V_i^u = [(w_i - \tau_i)/\gamma - (r_i + b_i + q_i)\bar{e}_i / q_i]/r_i, \quad i = 1, 2. \tag{11}$$

Given the international difference in unemployment benefits, an unskilled worker faces a lower after-tax wage $(w_1 - \tau_1)$ in the home country than in the foreign one, as shown in section 4 above. Thus, as implied by (11) and its foreign counterpart, the life-time utility of an unemployed unskilled worker is lower at home than abroad (given that $p = p^*$ and hence $\gamma = \gamma^*$ in free trade). Consequently, if international migration is

allowed, unskilled labor will move from the home country to the foreign country. In other words, instead of attracting immigrants, the more generous unemployment benefits paradoxically drive home workers to emigrate.

Suppose that the number of immigrants allowed into a country is exogenously fixed by the host government. Without loss of generality, consider the case where one unit of unskilled labor is permitted to migrate from the home to the foreign country. To determine the migration's impact on unemployment, first consider what happens at constant p (= p^*), and hence at constant wages (w_i and w_i^*) and unemployment rates (u_i and u_i^*). The resulting changes in the employment level of unskilled labor are a reduction of $1-u_1$ units at home and an increase of $1-u_1^*$ units abroad, while the employment levels of skilled labor remain constant. Since $u_1 > u_1^*$ (as recalled from section 4), the decrease in home employment is smaller than the increase in foreign employment. Thus, total world employment of unskilled labor rises by $u_1 - u_1^*$ units.

It is helpful to decompose this rise in world employment into two conceptual components. First, $1-u_1$ units of unskilled employment are transferred from the home to the foreign country. Second, world employment is expanded by $u_1 - u_1^*$ units, all working within the foreign country. In referring to the impacts of these two components, we use the terms *employment-transfer effect* and *employment-expansion effect* in the following analysis.

The employment-expansion effect on (foreign and) world output is negative for good Y (and positive for X), by the Rybczynski (1955) theorem. Since the Rybczynski derivatives ($\partial Q^J / \partial L_i$, J = X, Y; i = 1, 2) are internationally equalized under free trade,

the employment-transfer effect on the world output of good Y (and X) is nil, by Mundell's (1957) type of reasoning.

On the consumption side, world demand for (normal) good Y (and X) is raised by the employment-expansion effect, which augments world income by $w_1^*(u_1 - u_1^*)$ units. The employment-transfer effect on world demand is zero, however, given that $w_1 = w_1^*$.

The rise in world demand for good Y and the decrease in world output of this good together create an excess world demand for Y. Therefore, *p* must fall to clear world markets. Then, (5) and its foreign counterpart imply that both u_1 and u_1^* rise, while u_2 and u_2^* both decrease. In other words, international migration raises (lowers) the unemployment rate of the migrating (stationary) factor in both countries.[16] What happens to the aggregate unemployment rate in each country, however, is again ambiguous.

5.2. Outsourcing

We model international outsourcing as the use of labor services of one country in the production activities of the other, without any physical movement of workers across national borders. Since the case of migration analyzed above involves movement of unskilled labor from the home to the foreign country, let us here consider the outsourcing of unskilled labor by foreign firms. Specifically (for ease of comparison with the migration analysis), suppose that the services of only $1 - u_1$ units of unskilled home labor

[16] The same result would hold if we allowed unrestricted migration of unskilled workers (as opposed to the one-unit migration considered here). In the equilibrium with unrestricted migration, however, at least one country would have to specialize completely in production.

are used by foreign firms, because of a quantity restriction. Assume that this restriction on outsourcing is enforced by the foreign government through a quota, which is auctioned to the foreign firms, with the resulting government revenue redistributed via a head subsidy to all workers (skilled, unskilled, employed and unemployed alike) residing in the foreign country. One implication of this assumption is that in equilibrium, every foreign firm incurs the same (auction-inclusive) cost for each of its unskilled workers, regardless of their country of residence.

With $1-u_1$ units of unskilled labor outsourced to the foreign country, home production uses $(1-u_1)\bar{L}_1-(1-u_1)$ units of unskilled labour, while foreign production uses $(1-u_1^*)\bar{L}_1^*+1-u_1$ units of the same input. This outsourcing has an employment-transfer effect, but clearly no employment-expansion effect. At the initial product-price ratio, the employment-transfer effect on world excess demand is again zero (as for migration). Therefore, the equilibrium value of p (and p^*) and each u_i (and u_i^*) all remain unchanged.

Of course, in the present case with $w_1 = w_1^*$, there is no incentive for firms in either country to engage in outsourcing. What the above analysis shows is that even if international outsourcing were carried out, it would have no impact on prices, wages, (world) output and consumption in equilibrium. This result is in sharp contrast to the impact of migration. Therefore, in the case where international trade is caused by a difference in unemployment benefits, migration and outsourcing have very different consequences. In particular, compared to outsourcing, migration causes a bigger rise (fall) in the unemployment rate of the internationally mobile (stationary) factor.

6. Technology-Induced Migration versus Outsourcing

Suppose now that the only difference between the two countries is technological. In particular, let industry Y be Hicks-neutrally more efficient at home than abroad. Then, in accordance with the analysis of Findlay and Grubert (1959) and Kemp (1964, 1969), the real wage of the input used intensively in good Y (X) will be higher (lower) in the home than in the foreign country in free trade. To be more specific, let λ be the Hicks-neutral productivity coefficient attached to the production function of Y. (Output of good Y is unit-elastic with respect to λ, for given levels of inputs in this industry). Then, the Samuelson correspondence implies the following generalization of (3):[17]

$$w_i = \lambda \omega_i(p/\lambda), \quad i = 1, 2. \tag{12}$$

From this equation and its foreign analogue, it can be readily verified that $\lambda > \lambda^*$ implies $w_2 > w_2^*$ (and $w_1 < w_1^*$). Then, from the home and foreign versions of (binding) constraint (2), we also have $u_2 < u_2^*$ (and $u_1 > u_1^*$).

With the higher wage and lower unemployment of factor 2, the home country would clearly be attractive to potential immigrants of skilled labor. (Similarly, there would be an incentive for unskilled migration to the foreign country.) The wage difference alone, moreover, would make outsourcing of skilled (unskilled) labor attractive to home (foreign) firms. We now compare these two alternative types of international skilled-labor movement (noting that unskilled-labor movements can be compared

[17] In turn, this generalization causes λ to enter (4) as well as functions $\tilde{\mu}^i, \tilde{L}^i$ and M.

similarly).[18]

6.1. Migration

If skilled labor were free to migrate without restriction, at least one country would be driven to complete specialization in production, as the only way to eliminate the wage- and unemployment-rate differentials mentioned above. To simplify the exposition, without affecting the main results, assume again that only one unit of labor is allowed to migrate.

To determine the migration's impact on unemployment, first consider what happens at constant prices, and hence at constant rates of unemployment. In this situation, home employment of skilled labor rises by $1-u_2$ units, since the home endowment of this factor has (by assumption) increased by one unit. Similarly, foreign employment of skilled labor decreases by the smaller amount $1-u_2^*$. Thus, world employment increases by $u_2^*-u_2$ units. As in section 5, decompose this world increase into two components—the transfer of $1-u_2^*$ units of skilled employment to the home country from abroad, and the expansion of world employment by $u_2^*-u_2$ units.

The employment-transfer effect on production of good X (Y) is negative (positive) at home, and opposite in sign abroad, in accordance with the Rybczynski theorem. The resulting change in world output of good X is ambiguous in sign, as determined by the

[18] It is also possible to show that the introduction of free trade has the following consequences for input *i* (= 1, 2): u_i diverges from u_i^* if $(-1)^i(u_i-u_i^*)\leq 0$ in autarky; or, if this autarkic condition does not hold, $u_i-u_i^*$ changes sign. The same statement still holds if u_i and u_i^* are replaced by w_i and w_i^*, respectively, and the inequality is reversed. We could readily demonstrate, moreover, that the technological advantage in good Y leads the home country to export this good (as in the full-employment version of the standard trade-theoretic model).

analysis of Brecher and Choudhri (1982).[19] The employment-expansion effect on world production of this good, however, is clearly negative. Thus, the overall change in world output of good X is ambiguous in sign.

At the same time, the employment-transfer effect on world demand for good X is positive, as home income rises by $w_2(1-u_2^*)$ units, while foreign income falls by the smaller amount $w_2^*(1-u_2^*)$. This tendency toward an increase in world demand for good X is strengthened by the employment-expansion effect, which further augments home (and world) income by $w_2(u_2^*-u_2)$ units.

If the (unambiguous) rise in world demand for good X exceeds the (possibly negative) change in the world output of this good, *p* must rise to clear world markets, thereby causing the unemployment rate of skilled labor to increase (and of unskilled labor to decrease) in both countries. Alternatively, if *p* must fall to clear an excess world supply of good X, each country would experience a decrease (increase) in its rate of unemployment for skilled (unskilled) workers. As before, the change in the rate of aggregate unemployment is ambiguous in sign.

6.2. Outsourcing

Next, suppose that quota-restricted outsourcing transfers $1-u_2^*$ units of skilled employment to the home country from abroad. To ensure that all home firms incur the same cost per unit of skilled labor, assume again that the government of the labor-

[19] For example, their equation (3) implies that if the elasticity of factor substitution is constant in both industries and not smaller in good Y than in X, world output of the latter good falls.

receiving country allocates the quota by auction, which finances a uniform head subsidy for all domestic residents.

At initial prices, the outsourcing's total effect on excess world demand for good X is exactly the same as the above migration's employment-transfer effect on this demand. Because the employment-expansion effect no longer operates, however, the increase (decrease) in excess world demand for good X is smaller (larger) with outsourcing than with migration. Thus, if quota-restricted outsourcing raises the relative price of good X and hence increases (decreases) the unemployment rate of skilled (unskilled) workers in each country, so will migration, *a fortiori*.

Nevertheless, if completely unrestricted, outsourcing and migration would be perfect substitutes for each other. To see why, first suppose that outsourcing occurs freely, to the point at which $w_2 = w_2^*$ and hence $u_2 = u_2^*$.[20] Next, imagine that all foreign employees providing outsourced services are physically moved to the home country, along with enough jobless compatriots to keep the unemployment rate of skilled workers constant in each country. This move would simply replace outsourcing by migration, without otherwise affecting any aspect of world equilibrium.

7. Conclusion

This paper shows how globalization in the form of international trade, migration and outsourcing affects the unemployment rates of skilled and unskilled labor. Our analysis yields a number of surprising results. First, globalization may lead to significant changes in the unemployment rates of both types of labor, even though the impact on aggregate

[20] In this situation, at least one country must specialize completely in production, as implied by (12) and its foreign counterpart.

unemployment may appear to be small. Second, trade may cause unemployment rates to diverge between countries, even in instances where factor prices are equalized internationally. Third, in an open economy, an increase in unemployment benefits for one type of labor might reduce the unemployment rate of this labor. Fourth, in the case where trade is caused by an international difference in unemployment benefits for unskilled labor, migration by such workers raises their unemployment rate in both countries, but outsourcing leaves unemployment (and wage) rates unchanged. Finally, in the case where one country has a (Hicks-neutral) technical advantage in the good that is skilled-labor intensive, migration and outsourcing of skilled labor may reduce the rate of skilled unemployment in both countries. As these results suggest, the present model can help to bridge the gap between theory and policy in the continuing debate about the unemployment effects of economic globalization.

References

Bhagwati, Jagdish, Arvind Panagariya and T. N. Srinivasan, 2004, "The Muddles over Outsourcing", *Journal of Economic Perspectives*, 18 (Fall), 93-114.

Brecher, Richard A., 1974a, "Minimum Wage Rates and the Pure Theory of International Trade", *Quarterly Journal of Economics*, 88 (February), 98-116.

Brecher, Richard A., 1974b, "Optimal Commercial Policy for a Minimum-Wage Economy", *Journal of International Economics*, 4 (May), 139-149.

Brecher, Richard A., 1992, "An Efficiency-Wage Model With Explicit Monitoring: Unemployment and Welfare in an Open Economy", *Journal of International Economics*, 32 (February), 179-191.

Brecher, Richard A., Zhiqi Chen and Ehsan U. Choudhri, 2002, "Unemployment and Growth in the Long-Run: An Efficiency-Wage Model with Optimal Savings", *International Economic Review*, 43 (August), 875-894.

Brecher, Richard A., Zhiqi Chen and Ehsan U. Choudhri, 2009, "A Dynamic Model of Shirking and Unemployment: Private Saving, Public Debt and Optimal Taxation", manuscript, Carleton University.

Brecher, Richard A. and Ehsan U. Choudhri, 1982, "Immiserizing Investment from Abroad: The Singer-Prebisch Thesis Reconsidered", *Quarterly Journal of Economics*, 97 (February), 181-190.

Brecher, Richard A. and Ehsan U. Choudhri, 1987, "International Migration versus Foreign Investment in the Presence of Unemployment", *Journal of International Economics*, 23 (November), 329-342.

Copeland, Brian, 1989, "Efficiency Wages in a Ricardian Model of International Trade," *Journal of International Economics*, 27 (November), 221-244.

Davidson, Carl, Lawrence W. Martin, and Steven J. Matusz, 1999, "Trade and Search Generated Unemployment," *Journal of International Economics*, 48 (August), 271-299.

Davidson, Carl, Steven J. Matusz and Andrei Shevchenko, 2008, "Outsourcing Peter to Pay Paul: High-Skill Expectations and Low-Skill Wages with Imperfect Labor Markets", *Macroeconomic Dynamics*, 12 (September), 463-479.

Davis, Donald, 1998, "Does European Unemployment Prop up American Wages? National Labor Markets and Global Trade," *American Economic Review*, 88 (June), 478-494.

Findlay, Ronald and Harry Grubert, 1959, "Factor Intensities, Technological Progress, and the Terms of Trade", *Oxford Economic Papers*, New Series, 11 (February), 111-121.

Hoon, Hian Teck, 2000, *Trade, Jobs and Wages* (Northampton, MA: Elgar).

Johnson, H. G., 1959, "International Trade, Income Distribution and the Offer Curve", *Manchester School of Economic and Social Studies*, 27, 241-260.

Jones, Ronald W., 1965, "The Structure of Simple General Equilibrium Models", *Journal of Political Economy*, 73 (December), 557-572.

Kemp, Murray C., 1964, *The Pure Theory of International Trade* (Englewood Cliffs, NJ: Prentice-Hall, Inc.).

Kemp, Murray C., 1969, *The Pure Theory of International Trade and Investment* (Englewood Cliffs, NJ: Prentice-Hall, Inc.).

Kenen, Peter B., 1959, "Distribution, Demand and Equilibrium in International Trade: A Diagrammatic Analysis", *Kyklos*, 12 (November), 629-638.

Kimball, Miles S., 1994, "Labor-Market Dynamics when Unemployment Is a Worker Discipline Device", *American Economic Review*, 84 (September), 1045-1059.

Krugman, Paul R., 1993, "What do Undergrads Need to Know about Trade?", *American Economic Review*, 83 (May), 23-26.

Mitra, Devashish and Priya Ranjan, 2007, "Offshoring and Unemployment", Working Paper 13149, National Bureau of Economic Research.

Mundell, Robert A., 1957, "International Trade and Factor Mobility", *American Economic Review*, 47 (June), 321-335.

Mussa, Michael, 1993, "Making the Practical Case for Freer Trade", *American Economic Review*, 83 (May), 372-376.

Nickell, Stephen and Brian Bell, 1995, "The Collapse in Demand for the Unskilled and Unemployment across the OECD", *Oxford Review of Economic Policy*, 11 (Spring), 40- 62.

Rybczynski, T. M., 1955, "Factor Endowment and Relative Commodity Prices", *Economica*, New Series, 22 (November), 336-341.

Samuelson, Paul A., 1949, "International Factor-Price Equalisation Once Again", *Economic Journal*, 59 (June), 181-197.

Shapiro, Carl and Joseph E. Stiglitz, 1984, "Equilibrium Unemployment as a Worker Discipline Device", *American Economic Review*, 74 (June), 433-444.

Stolper, Wolfgang F. and Paul A. Samuelson, 1941, "Protection and Real Wages", *Review of Economic Studies*, 9 (November), 58-73.

Wood, Adrian, 1995, "How Trade Hurt Unskilled Workers", *Journal of Economic Perspectives*, 9 (Summer), 57-80.

Zhang, Ting, 2008, *International Outsourcing: An Open-Economy Model with Intermediate Goods and Economies of Scale*, Ph.D. dissertation, Carleton University.