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Abstract

We study the impacts of terms trade changes on absolute and the real wages of skilled and unskilled labor and their gaps for an economy specialized in export production. We show an interesting result where wage behavior as well as the skilled-unskilled wage gap depend on elasticity of import demand, unlike in 3x2 classical-neoclassical specific-factor model of trade. Although, our analysis is in the spirit of Stolper-Samuelson theorem, given the structure of our model, factor intensity plays no role in our results as in the specific-factor model.

JEL: F11, F16

Keywords: skilled-unskilled labor, wage gap, terms of trade

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Abstract

We study the impacts of terms trade changes on absolute and the real wages of skilled and unskilled labor and their gaps for an economy specialized in export production. We show an interesting result where wage behavior as well as the skilled-unskilled wage gap depend on elasticity of import demand, unlike in 3x2 classical-neoclassical specific-factor model of trade. Although, our analysis is in the spirit of Stolper-Samuelson theorem, given the structure of our model, factor intensity plays no role in our results as is in the specific-factor model.

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1 Introduction

The literature on wages of skilled and unskilled workers is extensive. In this, mostly empirical, vast literature much emphasis has been placed on the effects of international trade and technological improvement on wages (see Katz and Murphy (1992), Batra (1992), Bound and Johnson (1992), Cline (1997), Jones (1996), Beladi and Batra (2004), and Oladi and Beladi (2007), among others).

The celebrated Stolper-Samuelson theorem is central in a strand of literature that considers international trade as the main driving force behind the behavior of wages. Therefore, in such studies factor intensities play a crucial role (see Leamer (1993), Jones and Engerman (1996), and Beladi and Batra (2004), among others).[1] We contribute to this body of literature by revisiting the impacts of international trade on skilled and unskilled wages. Similar to the neoclassical 3x2 specific-factor model, a significant feature of our results is that factor intensities has no role. However, in contrast to the standard specific-factor model, the interconnection between markets is crucial in our findings.

We consider a model of an open economy with three sectors: export, import, and non-traded sector similar to Jones (1974), but instead of HOS set-up we assume factor specificity as in Neary

[1] In a recent paper Jones (2008) under reasonable assumptions shows that a terms of trade improvement can cause the real wage to fall in the poor country and to increase in the higher income country.

(1978). The consumption structure of our model is similar to Jones (1974) that the economy consumes only two of the commodities, the non-traded good and the imported good. That is, there is no domestic demand for the exported good. As for the production side of the economy, only two goods are produced, the non-traded good and the export good, i.e., our economy does not produce the importable. In addition to its theoretical appeal and curiosity, there are developing economies with economic structure similar to our model. Most of the oil exporting countries of the Persian Gulf export almost the entire oil production and they do not have import competing industries. Most diamond producing countries of Africa export the entire output to other part of the world. As in Beladi and Batra (2004) , we assume that unskilled labor is used in the non-traded sector and the skilled labor is used by traded sector.[2] Although, one could use alternative (and perhaps more complex) models to answer our question, we try to make the model as simple as possible. We show that the (real) skilled- unskilled wage gap decreases if the import demand is elastic. The condition of our result differs form the current literature.

The structure of the rest of the paper is as follows. We present our set up in section 2. Section 3 derives our results and section 4 concludes the paper.

2 The Model

Consider an open economy with two production sectors, a non-traded sector and an export sector. As in Beladi and Batra (2004) and Oladi and Beladi (2007), we assume that unskilled labor is only used in the non-traded sector, along with capital. Skilled labor and capital are inputs to the exportable sector. The production functions for our economy are given by:

$$X_e = F_e(L_s, K_e) = L_s f_e(k_e) \tag{1}$$

$$X_n = F_n(L_u, K_n) = L_u f_n(k_n) \tag{2}$$

where X_e, X_n are the production levels in export and non-traded sectors, while L_s, Lu, K_e, K_n are skilled labor, unskilled labor, capital usage in exportable sector, and the capital usage in non-traded sector, respectively. Moreover, k_e and k_n are the capital-labor ratios. We maintain that markets for

[2]See also Oladi and Beladi (2007) for motivation of this assumption.

all goods and inputs are perfect and that all neoclassical assumptions regarding these production functions are held.

As in Jones (1974), we assume that the exportable good has no domestic consumption, thus the entire production is exported. On the other hand, in addition to the non-traded good, our economy consumes another good that is not produced domestically at all. The entire domestic demand of this good is satisfied by import.

Perfect competition ensures the following equilibrium conditions:

$$r = P_e f'_e(k_e) = P_n f'_n(k_n) \tag{3}$$

$$w_s = P_e(f_e - k_e f'_e) \tag{4}$$

$$w_u = P_n(f_n - k_n f'_n) \tag{5}$$

where r, w_s, w_u, P_e, and P_n are the capital return, skilled labor wage, unskilled labor wage, the exported good price, and the non-traded good price, respectively. Full employment conditions in the labor markets and capital market are given by:

$$L_s = \bar{L_s} \tag{6}$$

$$L_u = \bar{L_u} \tag{7}$$

$$L_s k_e + L_u k_n = \bar{K} \tag{8}$$

where $\bar{L_s}$, $\bar{L_u}$, and $\bar{K}$ are the fixed stocks of skilled labor, unskilled labor, and capital, respectively. As is implied by equation (8), capital is mobile across the economy.

Since the non-traded good is entirely produced and consumed domestically, we define the market clearing condition for this sector by:

$$X_n = D_n(\frac{P_n}{P_i}, I) \tag{9}$$

where D_n, P_i, and I are the demand for the non-traded good, import price, and income, respectively.

We define the income by the following equation.

$$I = P_e X_e + P_n X_n \tag{10}$$

We assume that export good is the numeraire, its price initially set to unity, and that our economy faces an globally determined terms of trade. Hence, our general equilibrium model is closed with 12 equations and unknowns. Our endogenous variables are X_e, X_n, L_s, L_u, k_e, k_n, r, w_s, w_u,D_n, P_n, and I. Note equations (3) and (10) represent two equations each. The exogenous variables are P_i, $\bar{K}$, $\bar{L}_s$, and $\bar{L}_u$.

3 Stolper-Samuelson Revisited

We are interested in the impact of terms of trade on absolute and real skilled and unskilled wages in Stolper-Samuelson's tradition. In addition, we address the effects of terms of trade on real and absolute wage gaps. Interestingly, we will show that market interconnection plays an important role in our results.

By differentiating equations (3)-(8) with respect to P_i, keeping all the other exogenous variables constant, and simplifying we get:

$$L_s dk_e + L_u dk_n = 0 \tag{11}$$

$$f_e'' dk_e - P_n f_n'' dk_n = f_n' dP_n \tag{12}$$

$$dw_s + k_e f_e'' dk_e = 0 \tag{13}$$

$$dw_u + P_n k_n f_n'' dk_n = (f_n - k_n f_n') dP_n \tag{14}$$

First we use equations (11) and (12) to find the effect on capital-labor ratios. By Solving these equations we get:

$$dk_e = -\frac{L_u f_n'}{\Omega} dP_n \tag{15}$$

$$dk_n = \frac{L_s f_n'}{\Omega} dP_n \tag{16}$$

where $\Omega = -(L_s P_n f_n'' + L_u f_e'') > 0$. Next, following Jones (1974), we can relate the the price change

in the non-traded good market with the that of imported good by:

$$dP_n = \frac{P_n(\eta + \mu - 1)}{P_i(\eta + \epsilon)} dP_i \tag{17}$$

where $\eta = -\frac{\partial D_i}{\partial (P_i/P_n)} \frac{P_i}{P_n}$, $\mu = \frac{\partial D_i}{\partial I} \frac{P_i}{P_n}$, $\epsilon = \frac{dX_e}{d(p_e/P_n)} \frac{(P_e/P_n)}{X_e}$, and D_i is the demand for import. Note that η is the import elasticity of substitution, μ is the the marginal propensity to import, and ϵ is the elasticity of export. Equation (17) establishes an important relationship between markets and plays a crucial role on the effect of terms of trade changes on factor intensity in production sectors. It is evident from this equation that if $\eta + \mu > 1$ then a deterioration in terms of trade would result in an increase in the non-traded good price. This, in turn, implies by equation (15) that the capital-labor ratio in the export sector would fall. On the other hand, equation (16) indicates that the capital-labor ratio increases in the non-traded good sector as a result. Now, solve equations (13) and (14) and use equations (15) and (16) to obtain:

$$dw_s = \frac{P_e k_e L_u f_n' f_e''}{\Omega} dP_n \tag{18}$$

$$dw_u = [(f_n - k_n f_n') - \frac{P_n k_n L_s f_n' f_n''}{\Omega}] dP_n \tag{19}$$

Equations (18) and (19) lead us to our mail result. Accordingly, the impacts of terms of trade changes on skilled-unskilled wages depend on import elasticity.

Proposition 1. *Assume that the (uncompensated) demand for import is elastic. Then a deterioration in terms of trade decreases (increases) skilled (unskilled) wages, resulting in a decline in skilled-unskilled wage gap.*

This result is intuitive. Assuming that the import demand is elastic, an increase in the price of imports reduces the demand for imports and thus the spending on imports. At the initial non-traded good price, and therefore given income, the spending on the non-traded good should go up, implying an increase in demand for the non-traded good. This in turn leads to an increase in the non-traded good price. All this is summarized by equation (13). Given the increase in demand for the non-traded good (and its price), the production of non-traded goods should also go up following the market clearing condition stated by equation (9). As the endowments of factors are constant for

our economy and unskilled (skilled) labor is specific, the increase in production of non-traded good is possible only if capital is moved from the export sector to the non-traded sector, lowering capital intensity in the export sector and raising it in the non-traded good sector as indicated by equations (15) and (16). On the other hand, such movement of capital raises the (value of) marginal product of labor and thus the wage rate in non-traded sector and lowers them in export sector. Recall that the price of exports is constant and the price of the non-traded good goes up.

It is interesting to know the impact on return to capital. By differentiating equation (3) we get $dr = f_e'' dk_e$. Using this as well as equation (15) we conclude the following corollary.

Corollary 1. *Assume that the (uncompensated) demand for import is elastic. Then, a deterioration in terms of trade increases the return to capital.*

Since the value of marginal product of capital for the non-traded sector increases at the initial return to capital while that of export sector remains unchanged, the deterioration of terms of trade leads to an increase in economy wide return to capital.

While the impact of terms of trade changes on absolute wages is important, the impacts on real wages is more crucial. To investigate this issue, we could define real wages in terms of the non-traded good. It is easy to re-write equations (3)-(5) in terms of non-traded good price by dividing both sides of these equations by P_n. By differentiating the resulting equations as well as equation (8) and re-arranging, we get the following similar expressions.

$$d\omega_s = -[\frac{1}{P_n^2}(f_e - k_n f_e') - \frac{1}{P_n^2}\frac{k_e L_u f_e' f_e''}{\Omega}]dP_n \tag{20}$$

$$d\omega_u = -\frac{1}{P_n}\frac{k_n L_s f_e' f_n''}{\Omega}dP_n \tag{21}$$

where $\omega_s = w_s/P_n$ and $\omega_u = w_u/P_n$ are real skilled and unskilled wages in terms of non-traded good.

Proposition 2. *Let the import (uncompensated) demand be (in)elastic and assume a deterioration in terms of trade. Then: 1) real skilled wage falls (rises), 2) real unskilled wage rises (falls), 3) skilled-unskilled wage gap falls (rises).*

4 Conclusion

We consider a simple model of trade that incorporates non-traded goods and captures the effects of market interconnection in analyzing wage behavior in response to terms of trade changes. We assumed that there is no domestic demand for the export good, no domestic production of imported good, and that the unskilled labor is used in non-traded good production and the skilled labor usage is only in the export good production, while capital is mobile across the economy. We showed that the behavior of absolute and real unskilled wages, as well as their gaps, crucially depend on elasticity of import. This feature is different from factor price behavior in standard factor-specific model of trade. Interestingly, given set up, the factor intensity plays no role.

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