Welfare effects of trade and labor market reforms

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This paper examines the welfare effects of tariff reductions and adjustments of wage subsidy that fix domestic unemployment in two models of a small open economy with unemployment. We show that in both settings the proposed policy reform improves welfare. This result provides a simple but strong rationale for trade liberalization in the sense that it raises welfare without increasing unemployment.

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1 Introduction

Unemployment is a serious concern in any country, for which some countries either resist or hesitate trade liberalization. Stiglitz (2005, p. 70), for example, says that 'statistics, however, often under-represent the true level of unemployment- for instance, the prevalent high levels of disguised unemployment.'[1)] According to standard trade theory, reductions in trade protection benefit a country, but simultaneously entail a negative income distribution effect on the comparative disadvantage sector, possibly resulting in more unemployment. Then, one has a natural question: is it possible to design a scheme of trade liberalization such that welfare improves without increasing unemployment.

1) However, recent evidence more or less supports that trade liberalization is a driving force of employment, e.g., WTO (2013, p. 236), Dutt et al. (2009), Felbermayr et al. (2011), and Hasan et al. (2012).

This paper provides an affirmative answer to this question by using two types of unemployment models of a small open economy. The first model, which is originally developed by Brecher (1974), assumes economy-wide unemployment due to a rigid wage prevailing in all sectors while the second model, which dates back to Harris and Todaro (1970), focuses on urban unemployment that stems from a rigid wage in the urban area.[2] In both models, we show that tariff reductions accompanied by adjustments of wage subsidy that leave unemployment unchanged necessarily improve welfare. This conclusion may serve as a helpful guide for practical policy-making of trade liberalization mainly in developing countries that hesitate trade liberalization due to the employment concern.

This paper proceeds as follows. Presenting a model of nationwide unemployment, Section 2 considers the welfare effect of an unemployment-neutral policy reform. Section 3 makes the same exercise in the Harris-Todaro (1970) model. Section 4 concludes.

2 Economy-wide unemployment

This section incorporates economy-wide unemployment into a competitive model of a small open country, say Home. Home imports Good 1, which is subject to a specific import tariff t, and exports Good 2 (numeraire) that is freely traded.[3] As remarked earlier, Brecher (1974) first develops this model, but we formulate his model by using duality concepts. Denoting by p and w a world price of Good 1 and a wage rate of Home measured by Good 2, consider the following function:[4]

2) Edwards and Edwards (1994) and Bhagwati et al. (1998) offer a comparative account of these models.

3) As shown later, our result is robust in the export tax case where t is negative.

4) See Neary (1985), Kreickemeier (2005), and Falvey and Kreickemeier (2007) for more details.

$$r(p+t, w-s) \equiv \max_{y_1, y_2, L} \{(p+t)y_1 + y_2 - (w-s)L : (y_1, y_2, L) \text{ is feasible}\},$$

where s is a wage subsidy, $y_i, i = 1, 2$ is an output of Goods 1 and 2, and L is labor employed in Home. The usual envelope properties yield

$$r_p(p+t, w-s) \equiv \frac{\partial r(p+t, w-s)}{\partial(p+t)} = y_1$$
$$r_w(p+t, w-s) \equiv \frac{\partial r(p+t, w-s)}{\partial(w-s)} = -L.$$

In words, partially differentiating $r(\cdot)$ with respect to the price of Good 1 and the wage rate respectively yields the supply of Good 1 and the employment level (with a negative sign). Therefore, domestic unemployment is defined by $\overline{L} - L = \overline{L} + r_w(p+t, w-s)$, where $\overline{L}$ is the labor endowment of Home.

Using the above function, Home's income-expenditure equality is

$$\begin{aligned} e(p+t, u) = & r(p+t, w-s) - (w-s) r_w(p+t, w-s) \\ & + t \left[e_p(p+t, u) - r_p(p+t, w-s) \right], \end{aligned} \tag{1}$$

where $e(\cdot)$ is an expenditure function, the first line of the right-hand side is the value of outputs, and the second line of the right-hand side represents tariff revenue. Eq. (1) contains one endogenous variable u, with all the other variables being exogenous. Totally differentiating it with respect to u, t and s, we have

$$(e_u - t e_{pu}) du = \left[t(e_{pp} - r_{pp}) - (w-s) r_{pw} \right] dt + \left[t r_{pw} + (w-s) r_{ww} \right] ds. \tag{2}$$

We now define tariff reductions and adjustments of the wage subsidy that leave domestic unemployment $\overline{L} + r_w$ unchanged. Since a change in unemployment is computed as $d\left[\overline{L} + r_w(p+t, w-s)\right] = r_{wp} dt - r_{ww} ds$, t and s have to change according to

$$ds = \frac{r_{pw}}{r_{ww}} dt, \tag{3}$$

so as to fix domestic unemployment, i.e., $d\left(\overline{L}+r_w\right)=0$. Eq. (3), coupled with the properties $r_{pw}<0$ and $r_{ww}>0$, suggests that the wage subsidy must be raised ($ds>0$) as tariffs are reduced ($dt<0$) in order to leave unemployment unaltered. The reason is that because reduced tariffs decrease domestic production of Good 1 and domestic employment, the initial employment level is restored by raising the wage subsidy.

Based on the preliminaries thus far, we explore the welfare effect of the unemployment-neutral policy reform. For this purpose, we make an assumption that is familiar in the literature:[5)]

Assumption 1. $e_u-te_{pu}>0$.

Then, we can arrive at:

Proposition 1. *Under Assumption 1, tariff reductions accompanied by adjustments of the wage subsidy that fix domestic unemployment benefit Home.*

Proof. Substituting (3) into (2), the right-hand side of (2) becomes

$$\frac{t\left[r_{ww}(e_{pp}-r_{pp})+r_{pw}^2\right]}{r_{ww}}dt.$$

Thus, computing the welfare effect of the proposed policy reform amounts to making a comparative statics by using the above right-hand side. Straightforward manipulations lead to

$$du|_{dr_w=0}=\frac{t\left[r_{ww}(e_{pp}-r_{pp})+r_{pw}^2\right]}{r_{ww}(e_u-te_{pu})}dt.$$

5) This condition owes to Hatta (1977a, b). Falvey and Kreickemeier (2011, p. 284) provide its justification by stating that 'this is a clearly a very weak condition, and hence the assumption $\mu>0$ is made throughout the literature on piecemeal trade reform.' (μ is e_u-te_{pu} in our notation.)

The strict convexity of $r(\cdot)$, which implies $r_{pp} > 0, r_{ww} > 0$ and $r_{pp}r_{ww} - r_{pw}^2 > 0$, allows us to find that

$$r_{ww}(e_{pp} - r_{pp}) + r_{pw}^2 = \underbrace{r_{ww}e_{pp}}_{(-)} \underbrace{-r_{ww}r_{pp} + r_{pw}^2}_{(-)} < 0.$$

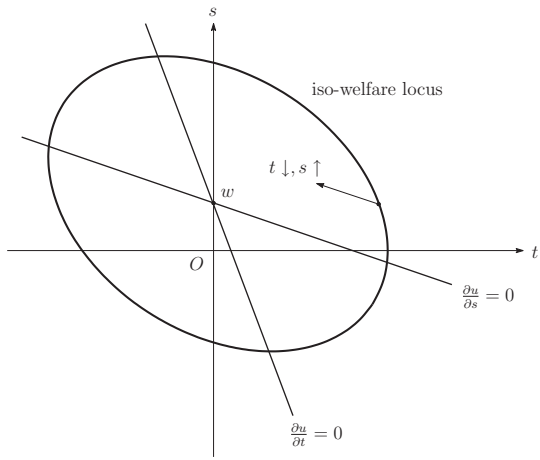
Accordingly, we obtain

$$sign\{\, du|_{dr_w=0}\} = -sign\{t \cdot dt\},$$

implying that tariff reductions ($dt < 0$) result in $du|_{dr_w=0} > 0$. ||

The intuition for Proposition 1 is as follows. From the small country assumption, unemployment is the only market distortion, and hence the first best outcome is given by free trade ($t = 0$) and $w = s$. And, tariff reductions are replaced by wage subsidy increases so that domestic unemployment is kept constant. Relating this observation to the above-mentioned argument, we find that the economy approaches the first best solution under this reform, leading to a positive welfare effect.

Figure 1 : Policy Reform and Welfare



The above finding may be better understood by using Figure 1. In the figure, the horizontal (resp. vertical) axis measures the tariff (resp. wage subsidy), and an ellipse gives an iso-welfare contour. As depicted in the figure, the first best solution is given by the intersection of two lines $\partial u/\partial t = 0$ and $\partial u/\partial s = 0$, which is $(0, w)$ in the present model. According to our policy recommendation, the tariff is reduced and the wage subsidy is raised as the arrow shows. Therefore, the post-reform equilibrium is necessarily inside the ellipse, implying that welfare improves as a result of this reform.

3 Urban unemployment

While the previous section deals with economy-wide unemployment, international and development economics has extensively utilized a model that focuses on urban unemployment developed by Harris and Todaro (1970). This section proves that the previous section's result survives the Harris-Todaro model. By using the same notations and techniques as those in the last section, we minimize the technical details.

The key in the Harris-Todaro model is that there is a wage differential between the two sectors, and that the expected wage received in the urban area equals that in the rural area:

$$\frac{L_1}{L_1 + L_u} w = w_2, \tag{4}$$

where L_1 and L_u are the labor employed in the Good 1 sector and the unemployment, respectively, w is the wage paid in the Good 1 sector, and w_2 is the counterpart in the Good 2 sector. In Eq. (4), w is exogenously given, and fixed to a highly rigid level whereas w_2 is endogenously determined. Defining $\lambda \equiv L_u/L_1$, Eq. (4) can be rewritten as

$$(1 + \lambda) w_2 = w. \tag{5}$$

In the literature, two versions of the Harris-Todaro models are developed,

depending on the intersectoral capital mobility. Letting $F^i(K_i, L_i), i = 1, 2$ be a well-behaved production function, the supply side in the specific capital case is given by

$$\begin{aligned}(p+t)F_L^1(K_1, L_1) &= w - s \\ F_L^2(K_2, L_2) &= w_2 - s \\ (1+\lambda)w_2 &= w \\ (1+\lambda)L_1 + L_2 &= L,\end{aligned}$$

where subscript L stands for a partial derivative with respect to the labor input, $K_i, i = 1, 2$ is specific capital in each sector, and L is the labor endowment. The first two equations are a profit maximization condition in each sector, and the last equation gives market-clearing of the labor market. These equations determine L_1, L_2, w_2 and λ, given $p + t$ and s.

If, by contrast, capital is intersectorally mobile, the supply side is characterized by[6)]

$$\begin{aligned}c^1(r, w - s) &= p + t \\ c^2(r, w_2 - s) &= 1 \\ (1+\lambda)w_2 &= w \\ c_r^1(r, w - s)y_1 + c_r^2(r, w_2 - s)y_2 &= K \\ (1+\lambda)c_w^1(r, w - s)y_1 + c_w^2(r, w_2 - s)y_2 &= L,\end{aligned}$$

where $c^i(\cdot), i = 1, 2$ is a unit cost function, subscripts r and w refer to a partial derivative with respect to the capital rental and wage, $y_i, i = 1, 2$ is output of each good, and K is the capital endowment. The first two equations are a condition for profit maximization, and the last two equations give market-clearing of the two factor markets. Five variables

6) The representation using the production function is left to the reader.

r, w_2, y_1, y_2 and λ are determined in this system.[7)]

Whether or not capital is intersectorally mobile, the urban unemployment rate λ is given by a function of $p+t$ and s as $\lambda(p+t, s)$.[8)] While most of the previous works focus on either of the above specifications, we cover both cases by utilizing the duality technique developed by Beladi and Chao (1993). To this end, let us consider the following function:

$$r(p+t, \lambda) \equiv \max_{L_1, L_2} \left\{ (p+t)F^1(K_1, L_1) + F^2(K_2, L_2) \middle| (1+\lambda)L_1 + L_2 = L \right\},$$

which has the usual envelope property:

$$r_p(p+t, \lambda) \equiv \frac{\partial r(p+t, \lambda)}{\partial (p+t)} = F^1(\cdot) = y_1.$$

Substituting the pre-determined value $\lambda(p+t, s)$ into this function, it becomes a function of $p+t$ and s as $r(p+t, \lambda(p+t, s))$.

Then, the equilibrium of a small open country is given by

$$e(p+t, u) = r(p+t, \lambda(p+t, s)) + t\left[e_p(p+t, u) - r_p(p+t, \lambda(p+t, s))\right], \quad (6)$$

which determines u, taking all the other variables as given. Totally differentiating (6) with respect to u, t and s, we get

$$(e_u - te_{pu})du = \left[r_\lambda \lambda_p + t(e_{pp} - r_{pp} - r_{p\lambda}\lambda_p)\right] dt + (r_\lambda - tr_{p\lambda})\lambda_s ds. \quad (7)$$

Let us once again define the unemployment-neutral reform of tariff reductions and wage subsidy adjustments. Since a change in λ is computed as $d\lambda = \lambda_p dt + \lambda_s ds$, this requires the two tax/subsidy rates to change according to

$$ds = -\frac{\lambda_p}{\lambda_s} dt. \quad (8)$$

In the case of economy-wide unemployment, the Home government raises the wage subsidy in response to tariff reductions, but the same is not

7) Note that this system is recursive as in the standard Heckscher-Ohlin model; r, w_2 and λ are determined in the top three equations only.

8) The exogenous variables other than $p+t$ and s are suppressed from the arguments of $\lambda(\cdot)$.

necessarily the case in the present setting. This is explained as follows. Differentiating the immobile- and mobile-capital models, we have

$$\text{immobile capital}: \lambda_p = \frac{(1+\lambda)^2 F_L^1 F_{LL}^2}{(p+t)F_{LL}^1[(1+\lambda)L_1 F_{LL}^1 - F_L^2 - s]} < 0$$

$$\lambda_s = \frac{(1+\lambda)\left[(p+t)F_{LL}^1 + (1+\lambda)F_{LL}^2\right]}{(p+t)F_{LL}^1[(1+\lambda)L_1 F_{LL}^1 - F_{LL}^2 - s]} < 0$$

$$\text{mobile capital}: \lambda_p = \frac{(1+\lambda)c_r^2}{w_2 c_r^1 c_w^2} > 0, \quad \lambda_s = \frac{(1+\lambda)c_w^1}{w_2 c_r^1}\left(\frac{c_r^2}{c_w^2} - \frac{c_r^1}{c_w^1}\right).$$

If we make Neary's (1981) assumption that requires Good 1 to be capital-intensive, $\lambda_s < 0$ follows in the mobile capital case as well. In other words, under Neary's (1981) assumption, the unemployment rate λ naturally falls as a result of an increase in the wage subsidy regardless of the intersectoral mobility of capital. In contrast, the effect of $p+t$ on λ differs in the two specifications for the following reason. In the immobile capital mode, L_1 has to increase in response to a rise in $p+t$ in the equation $(p+t)F_L^1(\cdot) = w - s$, from which $\lambda \equiv L_u/L_1$ falls. If capital is mobile across sectors, a rise in $p+t$ raises r through $c^1(r, w-s) = p+t$. This, in turn, lowers w_2 in the equation $c^2(r, w_2 - s) = 1$, and leads λ to rise. But, this difference in the sign of λ_p is irrelevant to the main conclusion to be proved subsequently.

Substituting (8) into ds of (7), its right-hand side simplifies to $t(e_{pp} - r_{pp})dt$. Then, a straightforward manipulation yields the welfare effect of the unemployment-neutral policy reform as follows.

$$du|_{d\lambda=0} = \frac{t(e_{pp} - r_{pp})}{e_u - te_{pu}}dt. \tag{9}$$

Thus, we establish:

Proposition 2. *Under Assumption 1, tariff reductions accompanied by adjustments of the wage subsidy that fix domestic unemployment benefit Home.*

Proof. It immediately follows from $(e_{pp} - r_{pp})/(e_u - te_{pu}) < 0$ that

$$sign\left\{ du|_{d\lambda=0} \right\} = -sign\left\{ t \cdot dt \right\}.$$

Therefore, if the trade tax takes a form of an import tariff $t > 0$, the present reform of trade liberalization ($dt < 0$) leads to $du|_{d\lambda=0} > 0$. ||

There is little to be explained in the immobile capital case since the intuition behind Proposition 1 applies to this case. In contrast, the mobile capital case should be separately explained. In this case, lower tariffs reduce the capital rental and raise the wage in the Good 2 sector. Thus, the intersectoral wage differential narrows, and the urban unemployment rate declines since migration from the urban to rural area occurs. As a result, the Home government can lower the wage subsidy, and the overall effect on welfare becomes positive because tariff-distorted resource allocation is (partially) removed without expanding unemployment.

Remark. We have thus far focused on the case of import tariffs, the foregoing arguments are readily applied to the case of export taxes. If the trade tax takes a form of an export tax, t is negative, and export tax reductions are represented by $dt > 0$. Consequently, we have $t \cdot dt < 0$ and $du > 0$.

4 Conclusion

This paper has theoretically proved that tariff reductions and wage subsidy increases that neutralize the employment effect unambiguously improve welfare. In addition, this conclusion is shown to survive both a model of nationwide unemployment and a model of urban unemployment.

Our result may be helpful in the practical policy-making of trade liberalization in the sense that trade liberalization and employment protection can be compatible.

Nevertheless, our affirmative evaluation of trade liberalization admittedly hinges on a number of simplifying assumptions. First, we have assumed a small open country, following most of the existing literature on tariff-tax reforms. However, unemployment is a phenomenon that is observed in developed countries as well as developing countries. Hence, it is important to check our result in a large-country setting. Second, our model simply attributes unemployment to an exogenously rigid wage. However, it is fruitful to develop a micro-founded model in which the rigid wage is determined by solving some optimization problem. Extensions along these lines are left as our future research agenda.

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