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## FACTOR MARKET DISTORTIONS, THE TRANSFER PROBLEM, AND WELFARE

Leonard F. S. WANG

*Abstract.* This paper shows that a unilateral transfer payment may paradoxically increase or decrease the paying country's welfare in the presence of a factor market distortion with stability conditions satisfied in a two country general equilibrium trade model. Our extension of the standard two country trade model reveals that a unilateral transfer in the presence of a domestic factor market distortion imposes an allocation effect on the domestic economy such that paradoxical welfare change may emerge when changes in the paying country's terms of trade interact with the distortion. The policy implication of our analysis suggests that the bias of the domestic factor market distortion and the direction in which the country's terms of trade change must be considered when a country is considering making a transfer to another country.

Traditional wisdom, introduced by Samuelson [17, 18] dealing with the welfare effects of unilateral transfer payment is that in the absence of market instability a transfer in the conventional  $2 \times 2 \times 2$  model decreases welfare in the paying country. Market instability, however, provides for the possibility of paradoxical welfare changes as noted by Samuelson, and Johnson [10] among others. The notion that a unilateral transfer is welfare immiserizing for the paying country in the presence of market stability has been fully analyzed in subsequent literature. For example Takayama [20] demonstrated that the welfare of the paying country will always deteriorate regardless of the direction of change in the terms of trade in a non-distortionary  $2 \times 2 \times 2$  framework with stability conditions fully satisfied. This result is somewhat paradoxical since the welfare of the paying country diminishes not only when the terms of trade shift against the paying country, but also when the terms of trade improve for that country. Furthermore, Takayama's analysis excludes the possibility of a transfer-induced improvement in welfare for the paying country.

The incorporation of distortions into the trade model dramatically changes the results of a transfer payment for both the paying country and the receiving country. Market imperfections are empirically present more often than not, hence they warrant complete analytical scrutiny. The importance of domestic market distortions has been comprehensively investigated in the area of international trade theory by Hazari [9], Magee [13], and most recently by Bhagwati and Srinivasan [5], among others.<sup>1</sup> Accordingly, factor market distortions have been

<sup>1</sup> See Ohyama [15], Parai [16], and Yu [23] for a discussion of the implication of domestic distortion in the topics of theory of tariffs and custom unions.

categorized into three major varieties; inequality of factor rewards between sectors for identical factors with price flexibility, equality of factor rewards between sectors with downward rigidity and sticky factor rewards in a subset of the sectors in the economy. Although the literature is rich analytically, the mainstream of the discussion of the impact of domestic distortions has not until recently synthesized distortion theory with the transfer problem. The major impact of factor market distortions with respect to unilateral transfers is the possibility of paradoxical welfare changes.

Paradoxical welfare changes created by a transfer payment have been recently explored within the context of the standard two country trade model with stability conditions satisfied by Brecher and Bhagwati [7] for the receiving country in the presence of policy-induced exogenous and endogenous distortions, and by Wang and Uhimchuk for the paying country in the presence of factor market reward rigidity [2]. Extensions of the standard trade model to incorporate a third agent in the presence of distortions has also produced paradoxical welfare changes as exemplified by Bhagwati et al. [4]. Yano [22] on the other hand, has shown in a recent paper, the possibility of paradoxical transfer induced welfare changes in the absence of distortions in a three agent model.

This paper shows that a unilateral transfer payment may paradoxically increase or decrease the paying country's welfare in the presence of a factor market reward differential with stability conditions satisfied in a two country, two commodity, two factor general equilibrium trade model. Furthermore, our analysis indicates that the direction of change in the terms of trade has a profound welfare effect on the paying country. The extension of the basic two country trade model reveals an allocation effect that is created by the unilateral transfer in the presence of a domestic factor market distortion. It is the strength of the allocation effect that is responsible for paradoxical welfare changes.

Our presentation of the analysis is as follows. In Section I we present the model and show it to be consistent with accepted literature. Section II presents our analysis of the welfare implications of a unilateral transfer payment on the paying country. In Section III we present a summary and concluding comments.

## I. THE MODEL

The framework of our model is the standard two country trade model where (*h*) denotes the home country and (*f*) denotes the foreign country. Both countries produce and consume two commodities,  $X_1$  and  $X_2$ , with the trade pattern being such that the home country is a net exporter of  $X_1$  and net importer of  $X_2$  with no impediments to trade. Hence, the aggregate social utility function is dependent upon the consumption of the two goods for both countries. We may express the aggregated utility functions for both countries in general form as:

$$U = U(C_1, C_2) \tag{1}$$

where  $U$  indicates the level of social utility in each country with  $C_1$  and  $C_2$  denoting the levels of domestic consumption of commodities  $X_1$  and  $X_2$ .

The production functions for consumables are given by the expression

$$X_i = X_i(K_i, L_i), \quad i = 1, 2. \quad (2)$$

where  $K_i$  represents the amount of capital employed in the  $i^{\text{th}}$  industry and  $L_i$  is the amount of labor employed in the  $i^{\text{th}}$  industry. We shall assume that the production functions are well behaved and exhibit the properties of constant returns to scale with diminishing marginal returns to factor employment.

We shall assume that all markets are perfectly competitive with the exception that there exists a factor price distortion in the labor market created by, say, a labor union, and that entrepreneurs are profit maximizers. Consequently, we can expect that factors of production are employed up to the point where the value of each factor's marginal physical product is equated with the price paid for each factor. The equations regarding factor rewards in the presence of a wage differential are expressed by:

$$\alpha w_1 = w_2 = \alpha P X_{L_1}(K_1, L_1) = X_{L_2}(K_2, L_2), \quad \alpha \neq 1. \quad (3)$$

$$r_1 = r_2 = P X_{K_1}(K_1, L_1) = X_{K_2}(K_2, L_2) \quad (4)$$

where  $w_i$  is the wage rate and  $r_i$  is the rental rate of capital and  $P$  is commodity price index in terms of  $X_2$ . The factor market price distortion is introduced into the model in the form of a wage differential by specifying that  $\alpha w_1 = w_2$ ,  $\alpha > 0$ ,  $\alpha \neq 1$ , where  $\alpha$  is greater than one (less than one), then the wage rate in industry 1 is lower (higher) than the wage in industry 2. Thus when  $\alpha$  is equal to one then there is no wage differential between the two industries.

In this model we assume that there are no impediments to factor mobility and that all prices are flexible so long as a wage differential is maintained between the two industries. This implies that all factors of production will be fully employed such that:

$$L_1 + L_2 = \bar{L} \quad (5)$$

$$K_1 + K_2 = \bar{K} \quad (6)$$

where  $\bar{L}$  is the total available supply of labor and  $\bar{K}$  is the total available stock of capital.

The slope of the production possibility curve in the presence of the wage differential is given by:

$$\frac{dX_2}{dX_1} = -P\beta \quad (7)$$

where

$$\beta = \left( \frac{\alpha w_1 dL_1 + rdK_1}{w_1 dL_1 + rdK_1} \right), \quad \beta > 0.$$

It is obvious that  $\beta \cong 1$  as  $\alpha \cong 1$ . Equation (7) clearly indicates that in the presence of a domestic factor price distortion, the slope of the production possibility locus in equilibrium does not equal the commodity price ratio in the world market.

Allowing for the possibility of the home country making a unilateral transfer to the foreign country, the home country's budget identity can be written as:

$$PC_1 + C_1 \equiv PX_1(P) + X_2(P) - T \equiv Z(P) - T \quad (8)$$

and the foreign country's budget identity can be written as:

$$PC_{1f} + C_{2f} \equiv PX_{1f}(P) + X_{2f}(P) + T \equiv Z_f(P) + T \quad (9)$$

where  $C_i = C_i[P, Z(P) - T]$ ,  $C_{if} = C_{if}[P, Z_f(P) + T]$ , where  $T$  is the transfer in terms of  $X_2$ . We assume that  $T$  is initially equal to zero. For the sake of simplicity we shall assume that the value of the transfer is collected and distributed in each country respectively in lump sum non-distortionary forms. Note that the wage distortion in the home country is not imposed by government in this model, but, as mentioned above, the result of say a labor union's rent seeking activity.

When the home country makes a unilateral transfer to the foreign country, then according to the accepted literature, Samuelson [17, 18], Takayama [20] among others, the standard, transfer-induced, terms of trade condition is given by:

$$\frac{dP}{dT} = \frac{-(1 - m_h - m_f)}{(\eta_h + \eta_f - 1)E_2} \quad (10)$$

where  $m_h$  and  $m_f$  are defined as each country's marginal propensity to consume its import commodity and  $\eta_h, \eta_f$  are the usual elasticity of each country's offer curves, and  $E_2 = C_2 - X_2 > 0$ . Assuming that the Marshall-Lerner condition of  $\eta_h + \eta_f > 1$  are satisfied, then a transfer-induced shift in the terms of trade will be positive or negative for the home country according to whether  $m_h + m_f > 1$  or  $< 1$  respectively.

## II. WELFARE ANALYSIS

To begin the analysis of the welfare implications of a unilateral transfer payment within the standard two sector trade model in the presence of a domestic factor price distortion we differentiate the social utility function (1) and assuming consumer equilibrium,  $U_1/U_2 = P$ , we obtain:

$$\frac{dU}{U_2} = PdC_1 + dC_2. \quad (11)$$

Combining equations (7), (8), and (11) we obtain:

$$\frac{dU}{U_2} = P(1 - \beta)dX_1 - dT + E_2dP \quad (12)$$

Dividing both side of (12) by  $dT$ , and setting  $U_2 = 1$ , initially, without loss of

generality, we obtain:

$$\frac{dU}{dT} = P(1 - \beta) \frac{dX_1}{dT} - 1 + E_2 \frac{dP}{dT} \quad (13)$$

Recalling condition (10) and utilizing the well-known Jones' decomposition of the elasticities of the offer curves, equation (13) can be equivalently expressed as:

$$\frac{dU}{dT} = X_1(1 - \beta)e \frac{dP}{dT} - \frac{[(\eta'_h + \varepsilon_h) + (\eta'_f + \varepsilon_f)]}{(\eta_h + \eta_f - 1)} \quad (14)$$

where  $\eta'_h, \eta'_f$  are the pure substitution elasticities of import demand, and  $\varepsilon_h, \varepsilon_f$  are the elasticities of export supply, and

$$e = \frac{P}{X_1} \frac{dX_1}{dP}$$

is the price elasticity of domestic production of the exported commodity which will always be positive. The price elasticity of domestic production is a measure of producer response to changes in the relative price of the export commodity, while the elasticity of export supply is a measure of the nation's supply of the export commodity on the world market which incorporates not only production changes but also changes in domestic consumption of the exported commodity.

The first term of equation (14) captures the *allocation* effect of a unilateral transfer on the domestic economy. The sign of the allocation effect is dependent upon the direction of the terms of trade change and the direction of the factor market distortion.

Assume that the home country makes a unilateral transfer to the foreign country, and that the world market is stable such that the Marshall-Lerner condition is satisfied and neither factor is inferior in production. Therefore, the second term of equation (14) will always have a negative sign regardless of the direction of change in the terms of trade. If  $\beta$  is equal to one, then  $\alpha$  must also equal one implying the absence of a domestic factor price distortion, and the first term on the right hand side of equation (14) vanishes leaving the negative second term. Hence we have the traditional conclusion, as expressed by Takayama [20, p. 240], that the welfare of the paying country will always decline regardless of the direction that the terms of trade change.

In the presence of domestic factor price distortions we find that there are four distinct cases that must be examined. As will become evident below, we find that in the presence of domestic factor price distortions, changes in the terms of trade have profound effects on the welfare of the paying country. Moreover, we find that paradoxical results may be obtained in three of the four cases.

The first case that we shall examine is the case where the wage distortion is in favor of the export commodity,  $\beta > 1$ , implying that workers are paid less in the export industry than in the importable industry, and the orthodox deterioration of the terms of trade occurs as a result of a transfer paid by the home country. Under

these conditions it is apparent that the first term on the right hand side of equation (14) will be positive since  $(1 - \beta)$  is negative,  $dP/dT$  is negative,  $X_1$  is positive and  $e$  is positive. Here we find the possibility of a paradoxical result.  $dU/dT$  will be positive or negative depending on the relative magnitude of the positive first term and negative second term of equation (14). If the first term is weakly positive relative to the second term then  $dU/dT$  will be negative implying that welfare deteriorates as a result of the transfer. On the other hand if the first term of (14) is strongly positive relative to the negative second term then  $dU/dT$  will be positive implying that welfare is improved in the paying country as a result of the transfer. In this case we find that the deterioration in the terms of trade implies that the price of the export commodity decreases relative to the price of the import commodity. Since the export commodity is 'over-produced' at the pre-transfer equilibrium, the decrease in relative price of the export commodity decreases the level of production of the 'over-produced' exportable. Hence the transfer causes the economy to move towards a more efficient allocation of resources between the two sectors, which may, if the allocation effect is strong, improve welfare in the paying country. The efficiency gains from reallocation of resources then, is greater than the transfer of wealth to the foreign country.

Suppose that the transfer payment induces an improvement in the home country's terms of trade while the exportable sector is paying a wage that is below the competitive equilibrium wage,  $\beta > 1$ . In this case  $(1 - \beta)$  remains negative, while  $X_1$ ,  $e$ , and  $dP/dT$  are now positive. Hence, the first term on the right hand side of (14) is negative along with the second term. Thus  $dU/dT$  will be negative implying a "paradoxical" decrease in welfare when the terms of trade improve. This result may be rationalized by recalling that the export commodity is 'over-produced' at the pre-transfer equilibrium. The improvement in the terms of trade further stimulates production in this industry, thus exacerbating the misallocation of resources in this economy.

Suppose now that  $\beta < 1$ , implying that the wage premium is paid by the export industry. Hence, at the pre-transfer equilibrium the export commodity is 'under-produced' while the import commodity is 'over-produced'. If the home country's terms of trade deteriorate when a transfer is made,  $dU/dT$  will be negative in (14) because  $(1 - \beta)$  is positive along with  $X_1$  and  $e$ , while  $dP/dT$  is negative. In this case there is no paradox to the outcome. Welfare in the paying country decreases when that country makes a transfer. Again, the transfer exacerbates the misallocation of resources in this economy.

Finally consider the case in which the export industry pays the wage premium,  $\beta < 1$ , and the unilateral transfer induces an improvement in the terms of trade for the home country. We now find that all of the elements in the first term of (14) are positive while the second term remains negative. Once again the sign of  $dU/dT$  will depend upon the relative magnitudes of the terms on the right hand side of (14). When the first term of (14) is strongly positive relative to the negative second term then  $dU/dT$  will be positive indicating a non-paradoxical increase in welfare.

However, if the first term is weakly positive relative to the second term, then  $dU/dT$  will be negative producing a paradoxical decrease in welfare for a country whose terms of trade have just improved. Thus, the allocative effect of the unilateral transfer does not correct the pre-transfer misallocation of resources in this economy.

### III. SUMMARY AND CONCLUSIONS

In this paper we have provided an extension to the standard two country international trade model that incorporates a domestic factor market distortion in the form of a price differential for the same factor between the two sectors. The analysis we present shows that the factor market distortion, in the form of a wage differential created by a labor union to exemplify the situation, interacts with the change in the paying country's terms of trade and produces an allocative effect on the domestic economy. We argue that the allocation effect created by the transfer payment may, under appropriate conditions, reinforce the misallocation of domestic resources that exists in the pre-transfer equilibrium of the paying country. More importantly, our analysis reveals that the allocation effect of the transfer payment presents the possibility such that the transfer payment and the associated change in the domestic country's terms of trade may counteract the initial misallocation of resources between sectors and thereby increase welfare in the paying country. We argue that in order for welfare in the paying country to improve as a result of a unilateral transfer that not only must the allocation effect be in the appropriate direction but it must also be relatively strong provided that the world market is stable.

The policy implication of our analysis suggests that government ought to be extremely cautious when considering foreign aid when the domestic economy is characterized by a factor market distortion. Our analysis indicates that there is a strong chance that welfare paradoxes will be encountered. When a unilateral transfer is contemplated it is extremely important for the domestic government to determine the expected direction of any change in the terms of trade as well as the bias of the factor market distortion because these variables interact to produce the allocation effect and consequently affect domestic welfare.

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