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Terms of Trade and Welfare for a Developing Economy with an Imperfectly Competitive Sector

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ABSTRACT

The effect of terms of trade economy on the welfare of a small open economy is analyzed. It exports a homogeneous good and imports some brands of the differentiated good. It also produces some brands of the differentiated good which are not traded. A terms of trade deterioration causes resources to move to the non-traded, import-competing sector. The economy's income rises and the price index for the differentiated good falls, resulting in higher welfare. This accords well with the experience of developing economies to East and South-east Asia.

1. Introduction

In international trade theory and in economics, generally, a terms of trade improvement for an economy is thought to be welfare improving. Ceteris paribus, it increases real income of the economy and hence its command over goods and services. In policy debates also the deterioration of a country's terms of trade is an important and often an emotive issue. That this is of major concern of theorists and policy-makers can be gauged from the importance accorded to the Prebisch-Singer hypothesis in development economics.

In recent times the most spectacular terms of trade deterioration was the one associated with the oil-price increases in the 1970s--events which terminated the golden age of Western capitalism and with it the Keynesian consensus in policy-making. The oil-price increase also affected the performance of non-oil developing countries adversely. Indeed a significant part of the slowdown in their growth has been attributed to this phenomenon.

In the realm of international finance, on the other hand, simple text-book Keynesian models tell us that a real devaluation--a terms of trade deterioration--improves a country's trade balance and hence increases its real income. In policy circles also a real devaluation has been very popular tool for stabilization--indeed it forms a cornerstone of the so-called structural adjustment programs associated with the IMF and the World Bank. A country will not devalue if it knows it is shooting itself in the foot by doing so. Therefore there is a presumption that it must improve its welfare by devaluing.

Which of the above views is correct? More precisely is it possible that a terms of trade deterioration can improve welfare? Is it the case that it is possible only when we have unemployment as in Keynesian models and not in smoothly working markets of neo-classical economics? There has been a lot of work on the implications of a terms of trade deterioration in open economy macroeconomics but this literature has emphasized the Harberger-Laursen-Metzler effect and not the welfare consequences directly.

In the last two decades beginning with Krugman (1979) (see also Ethier (1982)) international trade theory has changed beyond recognition due to the incorporation of imperfect competition (see Helpman and Krugman (1989) for an overview). Parallel to this has been the introduction of non-competitive behaviour in optimizing models in macroeconomics--the New-Keynesian macroeconomics (see the papers in Mankiw and Romer(1991) especially Cooper and John (1988)). Matsuyama (1993) presents examples from other areas in economics where such non-competitive general equilibrium models have been used. These developments open the door to the possibility that some phenomena which do not seem to make sense in a competitive framework could at least be analyzed sensibly and even found to be welfare-improving.

In this paper, following the recent non-competitive trade and macroeconomics literature, I set up a full-employment monopolistically competitive model of a small open economy and show that a worsening of its terms of trade could improve its welfare. The model has optimizing firms and households which enables me to address welfare questions. In doing so I (hopefully) provide a link between macroeconomics and traditional concerns of international trade theory.

This accords well with the experience of East and South-east economies in the recent past --I have deliberately chosen terms of trade changes which are not dramatic. Thailand, for instance, saw a growth in GDP of 49 per cent between 19990 and 1995, when its export prices grew by 18 per cent while the price of its imports increased by 21 percent. Singapore during the same period also had a GDP growth of 49 per cent and its export and import prices fell by 18 per cent and nine per cent respectively.

The adverse terms of trade shock leads to an expansion of the import-competing domestic sector, which is monopolistically competitive. This raises national income and lowers the price index thereby raising welfare. The terms of trade deterioration increases the level of activity in a sector whose initial output was "too low" from the social point of view and thus is welfare improving. This could not have happened in a competitive model.

2. The Model

The consumers consume a homogeneous product and a differentiated good. Of the latter n brands are produced locally and n^* are imported. The excess of domestic production over domestic consumption of the homogeneous good is exported. The domestic brands of the differentiated good are non-traded. This assumption is common in the small open economy setting (see e.g., Venables ,1982, and Sen, Ghosh and Barman, 1997).

The (upper-tier) utility function of a representative consumer is assumed to be Cobb-Douglas

$$U = X^{\alpha} y^{1-\alpha} \tag{1}$$

This is maximized subject to the budget constraint

$$Z = P \, . \, X + y \tag{2}$$

The maximization exercise gives rise to the following demand functions

$$X = \alpha \, . \, Z / P \, . \tag{3}$$

and $y = (1 - \alpha) \, . \, Z$ (4)

For later we will use the indirect utility function

$$V \equiv q . P^{-\alpha} \, . \, Z \tag{5}$$

where α is the share of the differentiated good in consumption, y is the cosumption of the homogeneous good (the numeraire), P is the price index associated with the quantity index for the differentiated good X, q is a constant and Z is income. P and X are defined in equation (6) and (7) below. Assuming the number of consumers to be one, Z becomes the gross domestic product (or national income).

The price index is defined by

$$P = \left[\sum_{i=1}^{n} p_i^{1-\sigma} + \sum_{j=1}^{n^*} p_j^{*\,1-\sigma}\right]^{\frac{1}{1-\sigma}} \tag{6}$$

where $p_i(p_j^*)$ is the price of a domestic(foreign) brand and σ is the elasticity of substitution between brands. The quantity index for the differentiated goods X is defined by

$$X = \left[\sum_{i=1}^{n} x_i^{\frac{\sigma-1}{\sigma}} + \sum_{j=1}^{n^*} x_j^{*\frac{\sigma-1}{\sigma}}\right]^{\frac{\sigma}{\sigma-1}} \tag{7}$$

Demand for the domestic and foreign brands of the differentiated good are given by

$$x_i = p_i^{-\sigma} P^{\sigma} X \qquad i = 1,\ldots,n \tag{8}$$

$$x_j^* = p_j^{*\,-\sigma} P^{\sigma} X \qquad j = 1,\ldots,n^* \tag{9}$$

Below we shall assume that each producer is small in relation to the market and takes P and X as given and hence σ becomes the elasticity of demand facing a producer.

We shall be looking at symmetric equilibria and therefore in what follows we shall drop the subscripts i and j.

The homogeneous good is produced under competitive conditions with a constant returns to scale technology using two inputs, labour and capital. The price (unity for the numeraire) equal to marginal (and average) cost equation for this good is given in equation (10)

$$a_{Ly} . W + a_{Ky} . r = 1 \tag{10}$$

where W is the wage rate and r is the rental rate on capital. The a_{ij}'s are functions of the factor prices (this is also true of the coefficients in equation (11) below).

The differentiated good is produced under conditions of increasing returns to scale. The market structure for this good is monopolistically competitive. There are a large number of potential varieties available for production of which n brands are produced domestically.

The variable cost component in the differentiated goods sector uses a linear homgeneous technology employing labour and capital

$$a_{Lx} . W + a_{Kx} . r = m \tag{11}$$

where m is the marginal cost of producing a unit of output(x) in a representative firm.

Moreover, each firm has to employ some labour and capital as overhead. The fixed cost of production is given by

$$a_{LF} . W + a_{KF} . r = F \tag{12}$$

where an input with an "F" subscript denote its use as an overhead and F is the "fixed" cost. I assume that the inputs used in fixed cost are constant but the level of fixed cost changes with factor prices.

Profit maximization by the firms active in the differentiated goods market implies that in equilibrium the price of a domestically produced brand is a mark-up ($\sigma/(\sigma-1)$) on marginal cost (we are now using σ as the elasticity of demand).

$$(\sigma/(\sigma-1))(a_{Lx}.W+a_{Kx}.r)=p \qquad (13)$$

In addition we assume that free entry drives profits down to zero in the domestic differentiated goods industry -- the Chamberlinian "large group" case. Hence in equilibium for each firm the fixed cost F represents a proportion ($1/\sigma$) of total revenue (p.x) (equation (14) below), the rest, a proportion (σ-1)/σ of revenue, goes to cover the variable cost (equation (13) above).

$$(a_{LF}.W + a_{KF}.r)=p.x/\sigma \qquad (14)$$

There are two inputs labour and capital. The market-clearing equations for these are given below

$$a_{Ly}.Y+a_{Lx}.nx+a_{LF}.n=\bar{L} \qquad (15)$$

$$a_{Ky}.Y+a_{Kx}.nx+a_{KF}.n=\bar{K} \qquad (16)$$

where $\bar{L}$ and $\bar{K}$ are the domestic supplies of the two factors, Y is the output of the homogeneous good and nx is the domestic production of the differentiated good. Note that we are implicitly assuming that there are no internationally mobile factors of production.

There are two goods market equations one of which can be ignored by Walras' Law. We choose to eliminate the trade balance equation i.e., the difference between the production and consumption of the homogeneous good must equal the value of the imported brands of the differentiated good. We shall concentrate, instead, on the domestically produced brands of the differentiated good i.e., the non-traded goods market.

$$x = p^{-\sigma} . P^{\sigma-1} . \alpha Z \tag{17}$$

In a model such as ours there are two factors of production and three "lines of production" namely the homogeneous good, the variable cost component and the fixed cost component of the differentiated good. The relative factor intensities will play a crucial role in the analysis below. Also given that the number of factors is less than the "lines of production", factor intensities in value terms--i.e., shares in cost (the θ_{ij}'s below) will differ from the physical intensities--i.e., shares of an input used in a "line of production" (the δ_{ij}'s below).

The broad production structure that I have in mind is the following. The homogeneous good can be thought of as an agricultural product, which can either be consumed or used as raw material in the differentiated goods industry. Labour combines with this raw material and (mainly) overhead capital to produce the differentiated good. The factor shares in the variable cost component include the labour and capital used in the production of raw materials. In terms of factor shares, F is the least labour intensive, Y is in the middle and x is the most labour-intensive. In terms of physical shares, we will assume that Y's share in the economy's capital stock is less than its share in the economy's labour force[1].

This completes the specification of the model. We now turn to the terms of trade shock.

3. A Worsening of the Terms of Trade

Suppose now p^* rises i.e., each imported brand becomes more expensive. Since the economy trades the homogeneous good for foreign brands of the differentiated good this constitutes a

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[1] We are assuming $\delta_{Ly} > \delta_{Ky}$ where the δ_{ij}'s are the shares in the employment of the i^{th} factor in the j^{th} activity. This condition ensures that national income rises following a terms of trade deterioration.

terms of trade deterioration for the economy. What are the consequences of this on the production (and consumption) of domestic brands, on variety choice, on GNP and finally on domestic welfare?

Logarithmically differentiating equations, (10), (13) and (14) we have (a "hat" over a variable denotes a percentage change)

$$\theta_{Ly} \cdot \hat{W} + \theta_{Ky} \cdot \hat{r} = 0 \qquad (18)$$

$$\theta_{Lx} \cdot \hat{W} + \theta_{Kx} \cdot \hat{r} = \hat{p} \qquad (19)$$

$$\theta_{LF} \cdot \hat{W} + \theta_{KF} \cdot \hat{r} = \hat{p} + \hat{x} \qquad (20)$$

Where θ_{ij} is the share of the i-th input in the j-th cost equation.

We can solve the above three equations for $\hat{W}$, $\hat{r}$ and $\hat{p}$ in terms of $\hat{x}$. These are given in equations (21), (22) and (23) below

$$\hat{W} / \hat{x} = -\theta_{Ky} / \Delta \qquad (21)$$

$$\hat{r} / \hat{x} = \theta_{Ly} / \Delta \qquad (22)$$

$$\hat{p} = (\theta_{Ly} - \theta_{Lx}) / \Delta \qquad (23)$$

$$\text{where } \Delta \equiv \theta_{Lx} - \theta_{LF} > 0 \qquad (24)$$

Under our assumptions then $\hat{W} / \hat{x} < 0$, $\hat{r}/\hat{x} > 0$ and $\hat{p} / \hat{x} < 0$.

Then logarithmically differentiating the two factor market-clearing equations ((15) and (16)) and the goods market equilibrium condition (equation (17)), we can solve for $\hat{Y}$, $\hat{x}$ and $\hat{n}$

in terms of the percentage increase in the price of foreign brands $\hat{p}^*$. These messy derivations are relegated to the Appendix.

First I note (the details are in the Appendix in equations (A4) and (A5)) that

$$\hat{n} / \hat{p}^* > 0 \text{ and } \hat{x} / \hat{p}^* > 0$$

The additional assumptions under which these hold are also discussed in the Appendix.

Now

$$Z \equiv r\bar{K} + W\bar{L} \tag{25}$$

$$\hat{Z} = \lambda_k . \hat{r} + (1 - \lambda_k) . \hat{W} \tag{26}$$

$$\hat{Z} / \hat{x} = [-(1-\lambda_K)\theta_{Ky} + \lambda_K \theta_{Ly}]/\Delta \tag{27}$$

where λ_K is the share of K in GNP. $\hat{Z} / \hat{x}$ is positive given our assumption (see footnote 1 above) that $\delta_{LY} - \delta_{KY} > 0$, δ_{ij} being the share of the j^{th} industry in the employment of the i^{th} factor.[2]

Given $\hat{x} / \hat{p}^* > 0$, equation (27) implies $\hat{Z} / \hat{p}^* > 0$

Now $\hat{P} = \beta \hat{p} + (1 - \beta)\hat{p}^* + \beta \hat{n} / (1 - \sigma)$

where β is the share of domestic brands in the total expenditure on the differentiated goods.

Hence (equation (A7) reproduced here for convenience)

$$\hat{P}/\hat{p}^* = -(1 - \beta)\{1 + \sigma(\theta_{Ly} - \theta_{Lx})\Delta^{-1} - (\hat{Z} / \hat{x})\}(\delta_{Ly} - \delta_{Ky}) / \Omega < 0 \tag{A7}$$

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[2] $\delta_{Ly} > \delta_{Ky}$

or

$a_{Ly} . Y/\bar{L} > a_{Ky} . Y/\bar{K}$

or

$\theta_{Ly}/\theta_{Ky} > (1-\lambda_K)/\lambda_K$

Equation (A7) holds if the term in the curly braces is negative. In that case a rise in foreign brand prices cause entry and a decline in the price of domestically produced brands so much that the price index actually falls! Note that in models of monopolistic competition σ is likely to be high e.g., a value of 5 is not unrealistic. This makes it likely that P will fall when p^* rises.

Finally the effect on welfare is given by $\hat{V} = -\alpha \hat{P} + \hat{Z}$. This is unambiguously positive (given our assumptions, of course). Note that $\hat{V}$ hass the same sign as the usual real income change in international trade theory (i.e., $dU/(\partial U/\partial Z)$).

A rise in the price of foreign brands causes the demand for these to fall, ceteris paribus. Since imports fall both in physical and value terms, for balanced trade, so must exports. Therefore, either the production of the homogeneous good must rise and/or the consumption of these must rise. In fact both of these happen. the non-traded goods sector expands both becuase entry occurs and output per firm increases. The latter causes a fall in the price of domestic brands (equation (23)). The entry and the fall in domestic brand prices causes the price index of the differentiated goods to fall notwthstanding the initial tendency to increase because of the increase in the price of foreign brands. National income also rises.

It is not surprising that this raises welfare. In the domestic monopolistically competitive sector prices are higher than marginal cost. Therefore there is underproduction of the domestic brands from a social perspective. The terms of trade shock causes an expansion of this sector thereby raising welfare above the initial equilibrium.

4. Conclusions

In this paper I had set up a monopolistically competitive model of a small open economy. The economy exports a homogeneous good and imports some brands of the differentiated good. It also produces some brands of the differentiated good which are not traded.

A terms of trade deterioration causes resources to move to the non-traded, import-competing sector. The economy's income rises and the price index for the differentiated good falls, resulting in higher welfare.

I believe that the model has applications in developing economies with sizeable industrial sectors. It is, however, inappropriate for those countries which produce mainly agricultral goods and minerals.

APPENDIX

Logarithmically differentiating equations (15),(16) and (17), we have

$$\delta_{Ly}\hat{Y} + \delta_{Lx}\hat{x} + (1-\delta_{Ly})\hat{n} = (\hat{W} - \hat{r})[\delta_{Ly}\theta_{Ky}\epsilon_y + \delta_{Lx}\theta_{Kx}\epsilon_x] \qquad (A1)$$

$$\delta_{Ky}\hat{Y} + \delta_{Kx}\hat{x} + (1-\delta_{Ky})\hat{n} = -(\hat{W} - \hat{r})[\delta_{Ky}\theta_{Ly}\epsilon_y + \delta_{Kx}\theta_{Lx}\epsilon_x] \qquad (A2)$$

$$[1-(\sigma-(\sigma-1)\beta)(\theta_{Ly}-\theta_{Lx})\Delta^{-1} - \hat{Z}/\hat{x}]\hat{x} + \beta\hat{n} = (\sigma-1)\cdot(1-\beta)\hat{p}^* \qquad (A3)$$

where ϵ_i is the elasticity of substitution in production in the i^{th} industry (i=y,x). Remember ϵ_F =0.

We have $$[B]\begin{bmatrix}\hat{Y}\\ \hat{x}\\ \hat{n}\end{bmatrix} = \begin{bmatrix}0\\ 0\\ (\sigma-1)(1-\beta)\hat{p}^*\end{bmatrix}$$

where $b_{11} = \delta_{Ly}$

$b_{12} = \delta_{Lx} + \Delta^{-1}\cdot[\delta_{Ly}\theta_{Ky}\epsilon_y + \delta_{Lx}\theta_{Kx}\epsilon_x]$

$b_{13} = (1-\delta_{Ly})$

$b_{21} = \delta_{Ky}$

$b_{22} = \delta_{Kx} - \Delta^{-1}\cdot[\delta_{Ly}\theta_{Ky}\epsilon_y + \delta_{Lx}\theta_{Kx}\epsilon_x]$

$b_{23} = (1-\delta_{Ky})$

$b_{31} = 0$

$b_{32} = [1 + (\sigma-(\sigma-1)\beta)\dfrac{(\theta_{Ly}-\theta_{Lx})}{\Delta} - \dfrac{\hat{Z}}{\hat{x}}]$

$b_{33} = \beta$

and $\Omega \equiv \beta[b_{11}b_{22} - b_{21}b_{22}] - b_{32}(\delta_{Ly} - \delta_{Ky}) < 0$

In determining the sign of Ω, we know that $b_{11}b_{22} - b_{21}b_{22} < 0$. In addition we have assumed that b_{32} if negative is not "too big", since by assumption $\delta_{Ly} > \delta_{Ky}$. Note that b_{32} measures the excess supply in the market for home brands including the induced price effect and the effect on national income when x increases, ceteris paribus(i.e., given n and Y).

The comparative statics exercise yields

$$\hat{x} / \hat{p}^{*} = -(1-\beta)(\sigma-1)(\delta_{Ly}-\delta_{Ky}) / \Omega > 0 \quad (A4)$$

$$\hat{n} / \hat{p}^{*} = (1-\beta)(\sigma-1)(b_{11} b_{22} - b_{21} b_{22}) / \Omega > 0 \quad (A5)$$

$$\hat{P} \; / \; \hat{p}^{*} = \frac{(1-\beta)}{\Omega} (\delta_{Ky} - \delta_{Ly})(1 + \sigma(\theta_{Ly} - \theta_{Lx}) \Delta^{-1} - (\hat{Z} / \hat{x})) < 0 \quad (A6)$$

$$\hat{Z} / \hat{p}^{*} = (-(1-\lambda_K) \cdot \theta_{Ky} + \lambda_K \cdot \theta_{Ly}) \Delta^{-1} \cdot (\hat{x} / \hat{p}^{*}) \quad (A7)$$

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