DM/86/21

INTERNATIONAL MONETARY FUND

Research Department

The Determinants of Competitiveness and Profitability

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March 20, 1986

Summary

Competitiveness and profitability are two concepts that are widely used in policy evaluation and recommendations. In the work of the Fund, these two concepts are extensively used in the analysis of foreign trade flows, especially among industralized countries. However, despite this extensive use, these concepts are often only poorly defined because the usual macroeconomic models do not contain a fully specified microeconomic structure. This paper presents a framework in which these two concepts can be precisely defined and in which the interactions between competitiveness, profitability, and other macroeconomic variables can be analyzed. The analysis suggests that many discussions about competitiveness and profitability are misleading because they do not take into account that these two concepts represent endogenous variables that are interrelated with other macroeconomic developments.

In this paper, a precise definition of competitiveness and profitability involves the introduction of product differentiation, economies of scale, and monopolistic competition. With product differentiation, domestic output differs from foreign output, and the relative price of domestic output in terms of foreign output can thus vary, even for the small country; this is represented by the concept of competitiveness. With increasing returns to scale, profits are a function of output; this is represented by the concept of profitability. Finally, monopolistic competition is the market structure appropriate to the combination of product differentiation and economies of scale.

The main result of the paper is that competitiveness and profitability are dependent on macroeconomic developments and that the inter-relationships between competitiveness, profitability, and other macroeconomic variables depend or might vary over time depending on the length of the time horizon considered. For example, a rise in total domestic demand (e.g., induced by a expansionary fiscal policy), in the

*I wish to thank P. Dhonte, M. Xafa, and C. Adams for helpful comments and discussions, and Mrs. S. Chernik for editorial assistance.

short run (when wages are rigid), would lead to a real appreciation, a loss of competitiveness, a fall in exports, and an increase in profitability in all sectors of the home economy. However, in the intermediate run (when wages adjust to clear the labor market), the loss of competitiveness and the fall in exports would be stronger and profitability would increase in the home goods sector only and would fall in the tradables sector. In the long run (when everything can adjust), the loss of competitiveness might be reduced, but the fall in exports would be even stronger and profitability should return to normal levels in all sectors.

While competitiveness and foreign demand are often considered as two independent determinants of the trade balance, it is shown that changes in foreign demand should generally affect competitiveness since domestic producers would raise their prices if foreign demand goes up. This implies that the general equilibrium elasticity of exports with respect to foreign demand is lower than the partial equilibrium elasticity that measures only the direct effect of foreign demand on exports. Moreover, since the extent to which domestic producers raise their prices in response to the increase in foreign demand varies with the length of the time horizon considered the relationship between exports, competitiveness, and foreign demand might considerably vary over time depending on the nature and the persistence of the shocks that affect the equilibrium.

I. Introduction

This paper analyzes the determinants of competitiveness and profitability--two concepts that are widely used in Fund policy analysis. For example, both the merchandise trade model of the World Economic Outlook (WEO) exercise and the analyses of trade flows in country reports rely heavily on these two concepts. However, competitiveness and profitability often are ambiguously defined and not tied to general macroeconomic analysis. This paper provides a rigorous framework in which these two concepts can be clearly defined in the context of a model which incorporates product differentiation, increasing returns to scale and monopolistic competition in the context of a general macroeconomic model. In this analysis, competitiveness can be measured in terms of the price of domestic exportables relative to the price of exportables from competitor countries and profitability can be related to the ratio of output prices to wages.

The paper uses a framework that incorporates increasing returns to scale, product differentiation, and monopolistic competition because these features are necessary to explain both the large amount of two-way trade in slightly differentiated products that flows between industrialized countries, and the concepts of competitiveness and profitability. 1/

1/ In the macroeconomic literature, it is often implicitly assumed that consumers differentiate among goods only on the basis of the country of production so that even a small country has some monopoly power. At the

Existing partial equilibrium models of trade in differentiated products miss the essential point that competitiveness and profitability are dependent of ongoing macroeconomic developments. 1/ This paper takes into account these general equilibrium effects and derives the general determinants of competitiveness and profitability. This also allows for an examination of the effects of various government policies on measures of competitiveness and profitability. The paper should thus contribute to a better understanding of the forces that determine competitiveness and profitability and how government policies can affect them.

Competitiveness and profitability are shown to reflect a variety of macroeconomic factors including changes in fiscal policy and exchange rates. An expansionary fiscal policy, for example, will lead to a loss of competitiveness in both the short and long run. However, the short- and long-run effects of such a policy on profitability differ; in the short run, with fixed wages and exchange rates, an expansionary fiscal policy would increase profitability in both the tradable and home goods sectors. But as wages adjust, profitability will fall in the tradables sector and increase only in the home goods sector. A devaluation leads to a gain in competitiveness and an increase in exports in the short run. However, a large gain in competitiveness is not necessary to achieve a large increase in exports; on the contrary, for a given nominal devaluation a large increase in exports should be related to a small gain in competitiveness. 2/

It is often agreed that competitiveness and foreign demand play important but distinct roles in determining a country's exports or trade balance. However, since competitiveness reflects macroeconomic developments, competitiveness and foreign demand are not independent. Indeed, an increase in foreign demand will generally lead to a loss of observed competitiveness since domestic producers will take advantage of the increase in foreign demand to raise their prices. This also implies that

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1/ (Cont'd from p. 2) same time, it is also assumed that there are many producers in each country who produce the "national" good under perfectly competitive conditions, i.e., without using the monopoly power they would have if they acted collusively. This type of model leads to short-run results that are qualitatively similar to the results of this paper, however, this type of model has two serious drawbacks. First, the rationale for product differentiation is not very convincing. Why should consumers distinguish between goods produced in different countries and not between goods produced in, for example, different regions or different continents? Second, this type of model usually implies that no country can grow faster than its competitors without a continuous deterioration of the terms of trade. This is contrary to the experience of the fast growing East Asian countries.

1/ See Armington (1969) and Deppler and Ripley (1978).

2/ The reason for this seemingly counterintuitive result is explained in Section V.

a 1 percent increase in foreign demand, in equilibrium, will not lead to a 1 percent increase in exports because part of the increase in foreign demand will generally be choked off by the increase in the price of domestic exportables.

The remainder of this paper is organized as follows. Section II contains a brief description of the model which is adapted from Dixit and Stiglitz (1975) and Krugman (1979). The following sections, III through V, illustrate the endogeneity of competitiveness and profitability by examining the effects of various changes in macroeconomic conditions on competitiveness, profitability, and the trade balance. Section III analyzes the effects of an increase in real expenditure. Section IV describes the effects of an increase in foreign demand, and Section V analyzes the short-run consequences of a devaluation with fixed nominal wages. Section VI contains some concluding remarks.

II. The Model

This section describes the essential features of the model, which contains three building blocks: the demand side, which generates product differentiation; the supply side, which incorporates increasing returns; and the market structure, which incorporates monopolistic competition. The demand side, together with the market structure, describes how producers compete on domestic and international markets and this gives a precise meaning to the term competitiveness. The supply side, again combined with the market structure, shows how costs and prices are related and this gives a precise meaning to the term profitability.

The first central feature of this model is the utility function of consumers, which is given by: 1/

$$(1) \quad \ln U = (\alpha/\tau)\ln\left[\sum_{i=1}^{N}(h_i)^{\tau}\right] + ((1-\alpha)/\theta)\ln\left[\sum_{j=1}^{M_t}(T_j)^{\theta}\right]$$

where,

$$0 < \theta, \tau < 1, \qquad 0 < \alpha < 1$$

This utility function implies that consumers value diversity in the sense that they prefer one unit of two products over two units of one product. All varieties of the product groups h and T are assumed to be symmetric so that it is sufficient to concentrate on one product in each of the

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1/ See Appendix I for a summary of notation.

groups. Θ and τ represent the degree of substitutability among products in the same group. Products in the h group represent nontradables and N indicates the number of differentiated specifications of nontradables actually produced. Products in the T group represent tradables, which can be either exportables, x, or importables, y. Denoting the number of varieties of exportables produced at home by M_x and the number of varieties of importables produced abroad by M_y the utility function can be rewritten as:

$$(2) \quad \ln U = (\alpha/\tau)\ln\left[\sum_{i=1}^{N}(h_i)^{\tau}\right] + \left((1-\alpha)/\Theta\right)\ln\left[\sum_{j=1}^{M_x} x_j^{\Theta} + \sum_{j=M_x+1}^{M_t} y_j^{\Theta}\right]$$

where $M_t = M_x + M_y$. Due to the symmetry inside each group, the subscripts i and j will be omitted henceforth. h, x, and y indicate quantities consumed of each typical good in the respective groups. For nontradables, domestic consumption, h, is equal to domestic production, h_p, but this is not true for tradables.

The other central feature of the model is the assumption of the existence of economies of scale. Production in the two groups is characterized by: 1/

$$(3) \quad h = h_p = \begin{cases} 0 & \text{for } k_h < \bar{K}_h \\ (l_h)^{1/\beta} & \text{for } k_h \geq \bar{K}_h, \quad \beta > 1 \end{cases}$$

and,

$$(4) \quad x_p = \begin{cases} 0 & \text{for } k_x < \bar{K}_x \\ (l_x)^{1/\gamma} & \text{for } k_x \geq \bar{K}_x, \quad \gamma > 1 \end{cases}$$

where l_x and l_h represent labor input in a typical firm in the home goods and export industries respectively. $\bar{K}_h$ and $\bar{K}_x$ represent some initial captial stock that has to be installed by a typical firm before labor can be productive.

1/ These production functions imply a U-shaped average cost curve with the minimum average cost given by: $h(\text{min. AC}) = [K_h/w(\beta-1)]1/\beta$ in the home goods sector; an equivalent equation holds for the average cost curve in the exportables sector.

The pricing policy of producers can be determined by using the fact that the utility function (2) implies an elasticity of demand equal to $1/(1-\tau)$ for home goods and $1/(1-\Theta)$ for tradables. The condition that profit-maximizing firms equate marginal revenue to marginal cost therefore implies that:

$$(5) \quad p_h = \frac{\beta w}{\tau} h^{\beta-1}$$

$$(6) \quad p_x = \frac{\gamma w}{\Theta} x_p^{\gamma-1}$$

where w represents the wage rate and p_h and p_x, the price of home goods and exportables.

A central feature of this framework is the distinction made between the factors that can adjust on the various time horizons considered here. In this respect, it is assumed that over the long run all variables can adjust, and this is taken to imply that new firms will be formed until, in the long run, all firms make zero profits. (However, in the short and intermediate run, the number of firms is taken to be fixed.) 1/ This implies that, in the long run, output (of each typical firm) is a constant given by:

$$(7) \quad \bar{x}_p = \left(\frac{r}{w} \frac{\bar{K}_x \Theta}{\gamma-\Theta}\right)^{\frac{1}{\gamma}}$$

and

$$(8) \quad \bar{h}_p = \left(\frac{r}{w} \frac{\bar{K}_h \tau}{\beta-\tau}\right)^{\frac{1}{\beta}}$$

where r is the rental price of capital. 2/ A description of the qualities of the long run, especially the discount factor and the treatment, of uncertainty is left out at this point in order to keep the analysis focused on "competitiveness" and "productivity."

1/ See pages 10 and 11 for a more precise definition of the differences between the short, intermediate, and long run.

2/ For the small country, the price of capital is determined by the rest of the world.

Equilibrium in the labor market implies that labor supply, $\bar{L}$, is equal to labor demand, that is:

$$(9) \quad \bar{L} = M_x l_x + N l_h = M_x x_p^{\gamma} + N h^{\beta}.$$

In the short run, when wages are fixed and the exchange rate determined by the authorities, the labor market no longer clears. 1/ In this case, employment is variable and determined by labor demand alone. In the intermediate and long run, however, it is assumed that the labor market clears so that employment is fixed at the full employment level.

To complete the description of the general equilibrium, it is necessary to return to the demand side which describes how consumers react to changes in relative prices. For consumers in the home country, the relative demands for importables and exportables is given by:

$$(10) \quad \frac{p_x}{p_y} = \frac{p_x}{s} \equiv z = \left(\frac{x}{y}\right)^{\theta-1}$$

where θ is the degree of substitution between importables and exportables and s is the nominal exchange rate expressed as the domestic currency price of one unit of foreign currency. The world price of importables in foreign currency is set equal to one, the domestic price of importables is thus given by s.

In addition, the substitution in consumption between home goods and tradables (exportables) is characterized by:

$$(11) \quad \frac{p_h}{p_x} \equiv \frac{p_h}{s}\frac{s}{p_x} \equiv \frac{q}{z} = \frac{\alpha}{1-\alpha}\frac{[M_x + M_y z^{\frac{-\theta}{\theta-1}}]x}{Nh}$$

where $q \equiv p_h/s$ is the real exchange rate and $z \equiv p_x/s$ is the terms of trade. Since the number of varieties produced abroad, M_y, is given for a small country, M_y is set equal to one.

1/ The analysis in this paper does not depend on whether wages are fixed because of private contracts or official action. The short run, with exogenous wages and exchange rates is designed to reflect the assumptions that are typically made in the context of the WEO exercise. It could also be interpreted as describing a situation in which wages are "sticky" in the short run and exchange rates are determined by financial market considerations.

The Cobb-Douglas form of the utility function also implies constant expenditure shares given by:

$$(12) \quad Nhp_h = \alpha E$$

where E represents total nominal expenditure, $E \equiv xp_xM_x + ysM_y + hp_hN$. 1/

Finally, the country is assumed to be small so that there are no appreciable repercussions. Hence, the foreign demand for each typical variety of domestic exportables can be written as:

$$(13) \quad x_p - x = Fz^{\frac{1}{\theta-1}}$$

where F is some shift parameter that depends on foreign income or changes in preferences abroad for this country's exportables. In the context of this model, the small country assumption does not imply an infinite price elasticity of export demand because the price eleasticity of demand facing each single producer (independently from where he is located) is equal to $1/(1-\theta)$ and is thus finite. The small country assumption is used here in the sense that the supply of importables is infinitely elastic and in that the equilibrium conditions for foreign suppliers and consumers are not considered. An important point in the context of this model is that total exports are given by: $(x_p-x)M_x$, i.e., the product of the number of firms in the exportables sector, M_x, and the amount exported by a typical firm in that sector. Exports of a small country can thus increase without any change in the terms of trade or competitiveness, if the number of firms producing exportables increases. Because it is assumed that the number of firms can change only in the long run, the long-run elasticity of total export demand is thus infinite for the small country; i.e., the small country can change the volume of its exports without any effect on competitiveness, z, if the exportables sector expand. In the short and intermediate run, however, when the number of firms (M_x) is fixed, the (absolute value of the) elasticity of export demand is equal to $1/(1-\theta) > 1$. The observed correlation between z and total exports thus depends on the length of the time horizon considered.

The hypothesis that the long-run elasticity of export demand is larger than the short-run elasticity is often used in applied work on international trade. The justification usually given for this hypothesis is the vague notion that in the long run everything is more flexible and

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1/ Expenditure is taken as exogenous here. In models of the pure theory of trade, it would be determined typically by the condition that the balance of trade has to be equal to zero.

thus the long-run elasticity should be larger. However, this paper provides an explicit rationale for the hypothesis. Moreover, this framework also provides an explanation of why a country can increase its exports without substantially affecting the relative price of its exports. If the growth occurs through the formation of new firms in the tradables sector (i.e., a rise in M_x), total exports can go up without any change in F (i.e, foreign demand) or z (i.e., the terms of trade). 1/ A corollary of this framework is that there are no limits on how fast a country can grow as long as the growth comes from an expansion of the tradable sector (provided its tradable sector is small relative to world trade).

The general equilibrium system described above can be characterized by nine variables, three relative prices (q, z, and w/s), and six quantities (x_p, x, y, $h_1 M_x$, and N). In the short run, when wages and the exchange rate are assumed to be fixed, one of the relative prices, w/s, is exogenous by assumption and N and M_x are given. The remaining variables are determined by the six equations (5), (6), and (10) through (13); in this case N and M_x are fixed but output per firm and total employment can vary. In the intermediate run, when wages are flexible, the equilibrium are determined by the above six equations plus the full employment condition (9); in this case, N and M_x are still fixed, and only output per firm can vary since total employment is given by equation (9). In the long run, when everything is flexible, the equilibrium is determined by the above six equations, plus the full employment condition (9) and plus the zero profit conditions (7) and (8); in this case N and M_x can vary but output per firm is given by equations (7) and (8).

In this framework, profitability and competitiveness can be defined precisely. With monopolistic competition, price always exceeds marginal cost and any increase in the volume of production leads to an increase in profits. Profitability can thus be linked directly to output, if output is above the long-run equilibrium level, profitability is higher than "normal" and vice versa. In the long run, profitability is, by definition, at its "normal" level. Profitability has often been measured in applied work as the ratio of price to wage rates. As can be shown using equations (5) and (6), this ratio is also an increasing function of output. In this analysis, increased profitability will be associated interchangably with increases in output or a higher ratio of prices to wage rates.

Competitiveness has generally been measured by the ratio of foreign export prices to export prices for domestic goods. In this model, foreign export prices are equal to the home country's import prices and the indicator of competitiveness is equal to z, i.e., the terms of trade. An increase in the home country's relative export prices, i.e., an improvement

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1/ If such growth, as opposed to cyclical effects, is the main determinant of exports even the short-run price elasticities of export demand will be equal to infinity. The distributed lags so often used in estimates of trade equations would thus not always be able to account for this effect.

in the terms of trade, is usually described as a deterioration in competitiveness. This seems the appropriate indicator of competitiveness since it indicates how much a country can export given the size of its tradables sector and the state of foreign demand.

The model is used in Sections III and IV to illustrate the endogeneity of competitiveness and profitability by calculating the effects of changes in domestic and foreign demand on competitiveness, profitability, the real exchange rate, and trade. It is also shown that these effects differ between the short, intermediate, and long run. This is a consequence of different assumptions about the variables that can adjust in the various "runs". In the short run, wages are fixed (as is the number of firms) and employment is variable; in the intermediate run, wages adjust to the full employment level; and in the long run, even the number of firms can adjust so that excess profits are eliminated. The analysis of the effects of a devaluation in Section V, however, is done only for the short run; because in the intermediate and long run, it is shown that a devaluation has no real effects.

III. The Effects of an Increase in Domestic Demand

This section discusses the short-, intermediate-, and long-run effects of changes in exogenous real expenditure on competitiveness, profitability, exports, and imports. Since the government sector is not modelled here, real expenditure is taken as exogenous, but any policy that affects real private expenditure will have the effects described in this section. The main result of the section is that any policy that increases real domestic demand reduces competitiveness, raises profitability in the nontradables sector, and may raise or reduce profitability in the tradables sector depending on the time horizon considered.

To simplify, real expenditure is defined as $RE \equiv E/p_h$, where p_h is the price of the nontradables. Moreover, with a constant expenditure shares utility function (see equation (12)), real domestic expenditure on home goods is a constant fraction, α, of total real domestic expenditure:

$$(14) \quad Nh = \alpha RE$$

In the short run, with N constant, this shows that production of each typical specification of home goods, h, increases by the same proportion as real expenditure. However, in the long run, production (of each typical specification of home goods) is given by $\bar{h}$, and thus the number of firms in the nontradables sector, N, increases by the same

proportion as real expenditure. This property of the model is used in the three cases discussed below:

1. the short run, with sticky wages and fixed exchange rates (and variable total employment and output per firm); this can also be described as the time period during which labor markets do not adjust to maintain full employment;

2. the intermediate run, with full employment, i.e., with labor markets that adjust (and variable output per firm); and

3. the long run, with full employment and with the number of firms determined by the zero profit condition.

1. The short-run, with sticky wages and fixed exchange rates

This subsection considers the effects of a change in real domestic expenditure on the real exchange rate, competitiveness, profitability, and the trade balance under the hypothesis that labor markets do not clear, i.e., that wages are sticky. It shows that an increase in real expenditure leads to an appreciation of the real exchange rate, a loss of competitiveness, and an increase in profitability in both the exportables and home goods sector.

To examine the behavior of the real exchange rate it is convenient to start with the determinants of the price of nontradables. With given wage rates, $\bar{w}$, the price of nontradables is determined by the conditions that profit-maximizing firms equate the wage rate to the marginal revenue product of labor:

$$(15) \quad p_h = \frac{\beta}{\tau} \bar{w} h^{\beta-1}$$

Dividing both sides by the fixed exchange rate, $\bar{s}$, and using equation (14), which determines the output of nontradables, h, this yields an expression for the real exchange rate (9):

$$(16) \quad q = p_h/\bar{s} = \frac{\beta}{\tau}\left(\frac{\alpha}{\bar{N}}\right)^{\beta-1} \frac{\bar{w}}{\bar{s}} RE^{\beta-1}$$

This gives the usual result that the real exchange rate is an increasing function of domestic demand or real expenditure. Indeed, the elasticity of the real exchange rate with respect to real expenditure $d\ln(q)/d\ln(RE)$, is equal to $\beta-1 > 0$. Profitability in the nontradables sector is also an increasing function of real expenditure since equation (16) can be transformed to yield:

$$(17)\quad \frac{Ph}{\bar{w}} = \frac{\beta}{\tau}\left(\frac{\alpha}{\bar{N}}\right)^{\beta-1} RE^{\beta-1}$$

To determine the effects of an increase in real expenditure on the tradables sector of the economy, the substitution between tradables and nontradables must be taken into account (equation (11)). The effects on competitiveness, ($Z=px/\bar{s}$) can be determined by using equation (11), the export demand function (equation (13)), and the profit maximizing conditions for exporters. 1/ The results give competitiveness as an implicit function of real expenditure which implies that the general equilibrium relationship between changes in competitiveness and real demand is given by:

$$(18)\quad \frac{d\ln(z)}{d\ln(RE)} = \beta\left\{1 + \frac{1}{K(\gamma-1)} + \left(\frac{1-K}{K}\right)\left(\frac{K\Theta+1}{1-\Theta}\right)\right\}^{-1}$$

where the parameter K is defined as the proportion of domestic production of tradables that is consumed at home: $K \equiv x/x_p$, $0 < K < 1$. 2/ This result implies that in general, competitiveness and real demand cannot be treated as two independent determinants of trade, even if nominal wages and exchange rates are sticky. The rationale for this result is that part of any increase in domestic expenditure falls on domestically produced tradables, i.e., exportables; domestic producers of exportables can satisfy this increased demand only by increasing their price if the supply is not infinitely elastic. However, at a given price for importables, the higher price for exportables implies a loss of competitiveness. 3/ Competitiveness is thus in general a function of domestic real expenditure.

1/ Using equations (13) and (14) in equation (11) yields:

$$q = z[(1-\alpha)RE]^{-1}\left[M + z^{\frac{-\Theta}{\Theta-1}}\right]\left[x_p - Fz^{\frac{1}{\Theta-1}}\right]$$

where q can be substituted out using equation (16) *and* $p_x/\bar{s} = (\gamma/\Theta)(\bar{w}/\bar{s})x_p^{\gamma-1}$, which yields:

$$0 = \frac{\beta(1-\alpha)}{\tau}\left(\frac{\alpha}{\bar{N}}\right)^{\beta-1}\frac{\bar{w}}{\bar{s}}RE^{\beta} - z\left[M + z^{\frac{-\Theta}{\Theta-1}}\right]\left[\left(z\,\frac{\bar{s}}{\bar{w}}\,\frac{\Theta}{\gamma}\right)^{\frac{1}{\gamma-1}} - Fz^{\frac{1}{\Theta-1}}\right]$$

2/ The elasticity in equation (18) is calculated around the long-run equilibrium which implies a zero trade balance and thus $M_x/M_y = K/(1-K)$.

3/ Equation (18) shows that competitiveness is independent of domestic real expenditure if (i) the supply of tradables is infinitely elastic,

However, the fixed wage rate and exchange rate imply that profitability varies inversely with competitiveness, since profitability in the export sector is defined as $P_x/w \equiv (p_x/s)(s/w) \equiv z(s/w)$. In this situation, an increase in expenditure leads to a deterioration in competitiveness (i.e., z rises) and an improvement in profitability (i.e., P_x/w also rises). Profitability thus improves in both sectors, tradables and nontradables, because an increase in demand leads to higher output in all sectors when wages and exchange rates cannot adjust.

Export production rises with z because the exchange rate and wages are fixed, but exports have to fall because competitiveness deteriorates. The elasticity of domestic production of tradables (exportables) can be calculated from equation (18) by using the supply function of tradables which can be written as $x_p = (z\theta s/\gamma w)^{1/(\gamma-1)}$. The elasticity of the supply of tradables with respect to competitiveness, z, is thus $1/(\gamma-1)$, combining this result with equation (18) yields:

$$(19)\quad \frac{d\ln(x_p)}{d\ln(RE)} = \left(\frac{\beta}{\gamma-1}\right)\left\{1 + \frac{1}{K(\gamma-1)} + \left(\frac{1-K}{K}\right)\left(\frac{K\theta+1}{1-\theta}\right)\right\} - 1$$

Imports will rise as demand increases for two reasons. First, an increase in expenditures will involve some increase in spending on importables. Second, the fall in the relative price of imports (expressed by the deterioration in competitiveness) will lead to a shift in the composition of consumption towards importables. These two effects are reflected in the elasticity of imports with respect to expenditures which is given by (from equation (11)):

$$(20)\quad \frac{d\ln(y)}{d\ln(RE)} = \beta\left\{1 + \left(\frac{\theta}{1-\theta}K\right)\left[1 + \frac{1}{K(\gamma-1)} + \left(\frac{1-K}{K}\right)\left(\frac{K\theta+1}{1-\theta}\right)\right] - 1\right\}$$

Equation (20) shows that the income elasticity of imports is greater than one. This result holds for total imports, yM_y, as well as for imports of each specification, y, because M_y is fixed in the short run. The income elasticity of imports exceeds unity because, although at given relative prices, the demand for imports would rise by the same proportion as overall expenditure, the deterioration of competitiveness shifts the composition of consumption towards importables.

3/ (Cont'd from p. 11) i.e., if $\gamma = 1$; and (ii) if all of domestic production of tradables is exported, i.e., if $K = 0$. In this latter case, there is no domestic demand for exportables; changes in domestic demand thus cannot affect the price of domestic tradables. However, even in the smaller OECD countries, a significant traction of manufacturing output is consumed domestically. If the manufacturing sector can be identified as the tradables sector, this would indicate that in most industrialized countries $K > 0$.

Since imports rise and exports fall, the trade balance deteriorates. The amount by which the trade balance deteriorates can be calculated by writing the trade balance in proportion to total expenditure as the difference between production and absorption of tradables:

$$(21) \quad (TB/E) = (p_x x_p M_x)/E - (1-\alpha)$$

This equation can be used to calculate the absolute change in the ratio (TB/E) as a function of the percentage change in real expenditure: 1/

$$(22) \quad \Delta(TB/E) = -\beta(1-\alpha)\left[\frac{\frac{1-K}{K(\gamma-1)} + \frac{1-K}{K}\left(\frac{K\Theta+1}{1-\Theta}\right)}{1 + \frac{1}{K(\gamma-1)} + \frac{1-K}{K}\left(\frac{K\Theta+1}{1-\Theta}\right)}\right] \frac{\Delta RE}{RE}$$

Equation (22) indicates that the deterioration in the trade balance is not just equal to the direct effect of the rise in imports caused by an increase in expenditure, but it is also the result of induced effects on competitiveness. Moreover, the impact of an increase in expenditure on the trade balance depends on the elasticity of supply of nontradables, $1/\beta$, as well as the degree of openness of the economy, i.e. $(1-\alpha)$, and the structure of the tradables sector, i.e., Θ and γ.

The effects of an increase in real expenditure in the short run with fixed wages and exchange rates are summarized below:

1/ Using the supply functions of tradables and nontradables in equation (21) yields:

$$(TB/E) = \frac{\gamma\tau}{\Theta\beta}\left(\frac{N}{\alpha}\right)^{\beta-1} M_y \, x_p^{\gamma} \, RE^{-\beta} - (1-\alpha)$$

Around the trade balance equilibrium (i.e., TB = 0) this gives:

$$\Delta(TB/E) = (1-\alpha)\left[\gamma - \beta\frac{\Delta x_p}{x_p}\right] \frac{\Delta RE}{RE}$$

Using equation (19) and simplifying then yields equation (22).

Nominal exchange rate	Real exchange rate	Competitiveness*	Volume of exports	Volume of imports	Profitability (employment, production)	
s	q	1/z	$M_x(x_p-x)$	M_y y	home goods	exportables
-	↑	↓	↓	↑	↑	↑

* A rise in the terms of trade, z, means a deterioration in competitiveness.

2. The intermediate run with full employment

It was shown above that an increase in real expenditure leads in the short run to an equiproportional increase in output of (each typical specification of) home goods. However, in the intermediate run with full employment, such an outcome implies that output in the other sector (i.e., production of exportables) has to fall. In this situation, elasticity of the production of exportables with respect to real expenditures will be sensitive to the fraction (ϕ) of the labor force that is occupied in the nontradable sector. 1/ This can be written as a decreasing function of real expenditure with elasticity: 2/

$$(23) \quad \frac{d\ln(x_p)}{d\ln(RE)} = -\frac{\beta}{\gamma}\frac{\phi}{1-\phi}$$

Since profitability in each sector is directly linked to output, equation (23) implies that profitability increases in the nontradables sector and declines in the exportables sector if expenditure goes up. The rationale for this result is that producers of nontradables can bid labor away from firms in the exportables sector because the price of their output has gone up relative to that of exportables and the exportables sector must therefore shrink. In the intermediate run, when the number of firms in the sector is fixed, this leads to a loss of profitability in the export sector.

1/ In the long-run equilibrium, this fraction is equal to $1/[(1+\Theta\beta(1-\alpha)/\gamma\tau\alpha)]$, see Appendix II, equation (A.8).

2/ Substituting equations (3), (4), and (14) into equation (2) yields:

$$x = \left(\frac{\bar{L}-Nh^{\beta}}{M_x}\right)^{\frac{1}{\gamma}} = \left(\frac{\bar{L} - (\alpha RE)^{\beta} N^{1-\beta}}{M_x}\right)^{\frac{1}{\gamma}}$$

An increase in demand also has to lead to a loss of competitiveness as can be shown by writing competitiveness as an implicit function of real expenditure, 1/ with that elasticity equal to:

$$(24)\quad \frac{d\ln(z)}{d\ln(RE)} = \beta\left\{\frac{\gamma + \phi\left[\frac{1}{1-\phi}\,\frac{1}{\gamma K} - 1\right]}{\frac{1}{(1-\Theta)K}\left[(1-K)(1+K\Theta)\right]}\right\}$$

An increase in real expenditure thus leads to a rise in the terms of trade or a deterioration in competitiveness. Intuitively, this rise in the relative price of exportables is due to a decrease in supply and an increase in demand for exportables. Supply decreases because labor switches to the nontradables sector and demand increases because the increase in expenditure goes partly towards exportables. Comparing the elasticity in equation (24) to the elasticity found for the short-run case (equation (18)), reveals that a given (percentage) increase in real expenditure leads to a larger loss of competitiveness in the intermediate run than in the short run. Competitiveness has to adjust less in the short run because the supply of exportables goes up since employment is variable. However, in the intermediate run, the supply of exportables goes down because labor switches to the nontradables sector. The reduced supply of exportables in the intermediate run has to lead to a higher price for exportables, i.e., a larger loss of competitiveness.

An increase in real expenditure also leads to a rise in the real exchange rate as can be shown by dividing the profit-maximizing conditions (equations (5) and (6)) for the two sectors; 2/ the resulting elasticity is equal to:

1/ The last equation of the footnote on page 12 can be rewritten as:

$$0 = (1-\alpha)\frac{\beta\Theta}{\tau\gamma}\left(\frac{\alpha}{\bar{N}}\right)^{\beta-1} RE^{\beta} - \left[M + z^{\frac{-\Theta}{\Theta-1}}\right]\left[x_p - Fz^{\frac{1}{\Theta-1}}\right]x_p^{\gamma-1}$$

differentiating logarithmically and using equation (21) yields equation (24).

2/ Using this in the labor market, the equilibrium condition yields:

$$\frac{q}{z} = \frac{\beta\Theta}{\tau\gamma}\left(\frac{\alpha RE}{\bar{N}}\right)^{\beta-1}\left(\frac{\bar{L} - (\alpha RE)^{\beta} N^{1-\beta}}{M_x}\right)^{\frac{-(\gamma-1)}{\gamma}}$$

$$(25)\quad \frac{d\ln(q)}{d\ln(RE)} = (\beta-1) + \left(\frac{\gamma-1}{\gamma}\right)\beta\left(\frac{\phi}{1-\phi}\right) + \frac{d\ln(z)}{d\ln(RE)}$$

Since z increases with increases in real expenditure, this implies the rise in the real exchange rate must (proportionally) exceed the improvement in the terms of trade (or the deterioration in competitiveness). Comparing equation (25) to the elasticity implicit in equation (16), it is apparent that the real exchange rate reacts stronger to an increase in expenditures in the intermediate run than in the short run.

The effects on the trade balance can be determined by using the conditions that the change in the trade balance in terms of the changes in expenditure and production of tradables is equal to (see footnote 1/ on page 14):

$$(26)\quad \Delta(TB/E) = (1-\alpha)\left[\gamma\frac{\Delta x_p}{x_p} - \beta\frac{\Delta RE}{RE}\right]$$

$$= \beta(1-\alpha)\left(\frac{1}{1-\phi}\right)$$

Comparing this result to equation (22) shows that the deterioration of the trade balance is stronger in the intermediate run than in the short run. The rationale for this is that in the short run the output of tradables can increase but in the intermediate run output of tradables decreases which has an additional negative effect on the trade balance.

The income elasticity of imports in the intermediate run can again be calculated from equation (11); it is equal to:

$$(27)\quad \frac{d\ln(y)}{d\ln(RE)} = \beta\left\{1 + \left(\frac{\gamma-1}{\gamma}\right)\left(\frac{\phi}{1-\phi}\right) + \left[1 + \left(\frac{\Theta}{1-\Theta}\right)K\right]\frac{\gamma + \phi\left[\frac{1}{1-\phi\gamma k} - 1\right]}{\frac{1}{(1-\Theta)K}\left[(1-K)(1+K\Theta)\right]}\right\}$$

Comparing this expression to the corresonding short-run elasticity reveals that the intermediate-run income elasticity of imports is larger because it leads to a larger loss of competitiveness.

The intermediate term effects of an increase in real expenditure with clearing labor markets or full employment are summarized below. To make this representation comparable to the previous table, it is also

assumed that nominal wages do not respond so that the exchange rate has to adjust. 1/ A nominal appreciation, i.e., a fall in s is required because wages determine the domestic price level and the required real appreciation can be achieved at a constant domestic price level only with a nominal appreciation.

Nominal exchange rate	Real exchange rate	Competitiveness*	Volume of exports	Volume of imports	Production (employment, profitability)	
					home goods	exportables
s	q	1/z	$M_x(x_p-x)$	M_y y		
↓	↑	↓	↓	↑	↑	↓

* A rise in the terms of trade, z, means a deterioration in competitiveness.

3. The long run

The effects of an increase in expenditure that persists in the long run are different from the intermediate-run effects, since long-run profits have to be zero in both sectors. Otherwise, new firms would be formed until profits are back to zero. Output per firm in each sector is thus given by equations (7) and (8) at $\bar{h}$ and $\bar{x}_p$. Real expenditure thus determines the number of firms in the home goods sector (N), rather than the output of each specification of home goods.

$$(28) \quad N = \alpha RE/\bar{h}$$

The full-employment condition then determines the number of firms operating in the exportables sector: $M_x = [\bar{L} - \alpha RE\bar{h}^{\beta-1}]/\bar{x}_p$, which implies that the elasticity of the number of firms in the exportables sector, with respect to changes in real expenditure, is equal to:

$$(29) \quad \frac{d\ln(M_x)}{d\ln(RE)} = -\frac{\phi}{1-\phi}$$

This shows that the number of firms in the exportables sector has to fall if expenditure increases.

1/ However, since only relative prices matter in this model, this choice is arbitrary; if nominal wages adjust appropriately, the exchange rate would remain unchanged.

Profitability, as measured by the ratio of prices to wage rates, is given by $p_x/w = (\gamma/\theta)\bar{x}_p^{\gamma-1}$ and $p_h/w = (\beta/\tau)\bar{h}^{\beta-1}$, which shows that the relative price of home goods in terms of exportables is fixed by:

$$(30) \quad \frac{p_h}{p_x} = \frac{q}{z} = \frac{\beta\theta}{\tau\gamma}\frac{\bar{h}^{\beta-1}}{\bar{x}_p^{\gamma-1}}$$

On the demand side, the substitution between tradables and home goods is affected by the change in the number of varieties available in these sectors (see equation (11)). Hence, the relative price of exportables in terms of importables, or the terms of trade have to change. 1/ The proportional change in the terms of trade that results in the long run from an increase in real expenditure is equal to:

$$(31) \quad \frac{d\ln(z)}{d\ln(RE)} = -\left(\frac{1-\phi}{1-\theta}\right)\left[\frac{\theta(1-K) + K/(1-K)}{1 - \phi(1+K)}\right]$$

Even in the long run, competitiveness deteriorates if real expenditure increases. However, in contrast to the short-run results, the real appreciation is proportionally equal to the deterioration in competitiveness because, in the long run, the supply of nontradables is more elastic. A given increase in real expenditure thus leads to a real appreciation that is smaller in the long run than in the short or intermediate run.

The deterioration in competiveness leads to a fall in foreign demand for each variety of exportables but, since the number of firms in that sector diminishes, total exports will fall more than predicted by the elasticity of the export demand function for each single good. Indeed, the long-run fall in total exports caused by an increase in domestic real expenditure is given by:

1/ Using equations (13) and (14) in equation (11) leads to

$$(q/z) = ((1-\alpha)RE)^{-1}\left\{\left[\bar{L} - \alpha RE\bar{h}^{\beta-1}\right]/\bar{x}_p + z^{\frac{1}{\theta-1}}\left[\bar{x}_p - Fz^{\frac{1}{\theta-1}}\right]\right\}$$

simplifying leads to:

$$\frac{q}{z} = \left\{\frac{\bar{L}}{(1-\alpha)RE\bar{x}_p} - \frac{\alpha}{(1-\alpha)}\frac{\bar{h}^{\beta-1}}{\bar{x}_p}\right\}\left\{\bar{x}_p - Fz^{\frac{1}{\theta-1}}\right\}$$

taking logarithmic deviations and using equation (29) yields equation (31).

$$(32)\quad \frac{d\ln(M_x(x_p-x))}{d\ln(RE)} = \frac{d\ln(M_x)}{d\ln(RE)} - \left(\frac{1}{1-\theta}\right)\left(\frac{d\ln(z)}{d\ln(RE)}\right)$$

$$= -\frac{\phi}{1-\phi} - \frac{1}{1-\theta}\left[\left(\frac{1-\phi}{1-\theta}\right)\left(\frac{\theta(1-K) + \frac{K}{1-K}}{1 - \phi(1+K)}\right)\right]$$

Conventional export demand functions would pick up only the second effect (i.e., the effect of z on exports of each single domestic firm in the export sector) since they are not normally estimated on long-run data and would thus miss the first effect that operates through the number of firms or specifications. This implies that if expenditure goes up in the long run (for example, because the country has discovered a new source of income, such as oil in the case of England and Norway), the reduction in total manufacturing exports would be much larger than suggested by the observed deterioration in competitiveness and the estimated short- or intermediate-run price elasticities of exports.

IV. The Effects of an Increase in Foreign Demand

This section discusses the short-, intermediate-, and long-run effects of changes in foreign demand for exportables on competitiveness, profitability, exports, and imports. The main result of the section is that an increase in foreign demand leads domestic firms in the tradables sector to raise their prices and thus leads to a deterioration of observed competitiveness. In discussions about the linkages between economies, it is often assumed that exports are a function not only of competitiveness but also of foreign demand. This notion is proxied here by the shift variable F in the export demand function. Since all income elasticies are equal to one in this framework, a 1 percent rise in income abroad should lead to an equiproportional rise in foreign demand for exportables and therefore to a 1 percent increase in F. However, as this section shows, this does not imply that a 1 percent rise in foreign demand leads to a 1 percent rise in exports because of the general equilibrium effects on competitiveness. The standard practice of treating competitiveness and foreign demand as two independent determinants of exports is thus not valid in the present framework.

As in the preceding section, three different cases will be discussed: equation (1) the short run with fixed wages and exchange rates; equation (2) the intermediate run with clearing labor markets; and equation (3) the long run.

1. Short-run effects with fixed wages and exchange rates

The short-run effects of an increase in foreign demand with fixed wages and exchange rates can be determined by using equation (18). Equation (18) shows that the real exchange rate is a function only of

real domestic expenditure. This implies that a change in foreign demand, F, does not affect the real exchange rate.

The effect of changes in F on competitiveness is given by the elasticity: 1/

$$(33)\quad \frac{d\ln(z)}{d\ln(F)} = \frac{1-K}{\left(\frac{1}{\gamma-1}\right) + \frac{(1-\theta K^2)}{(1-\theta)}} < 1$$

This implies that an increase in foreign demand leads to an improvement in the terms of trade or a loss of competitiveness. Since the elasticity in equation (28) is smaller than one, the proportional "loss" of competitiveness is smaller than the proportional increase in foreign demand. This analysis reveals why the concept "competitiveness" is often not very useful for policy analysis. Indeed, in this situation, producers do not "lose" competitiveness but take advantage of favorable markets to raise their prices relative to those of their competitors.

The use of the concept of competitiveness is also potentially misleading because it is often assumed that an improvement in competitiveness (a fall in z) is desirable because it leads to higher exports. This misses the point that competitiveness is an endogenous variable and can therefore not be directly manipulated by the authorities. 2/

As mentioned above, profitability in the export sector is directly related to the terms of trade if wages and exchange rates are fixed since $p_x/\bar{w} = z(\bar{s}/\bar{w})$. Profitability and employment in the export sector therefore increase if foreign demand goes up. 3/ However, profitability and employment in the home goods sector are not affected by a change in F, since output in that sector is determined only by real domestic expenditure (equation (14)).

The effects on the trade balance can be determined by starting from equation (21) and the condition that with fixed wages and exchange rates $d\ln(x_p) = 1/(\gamma-1)d\ln(z)$.

$$(34)\quad \Delta(TB/E) = (1-\alpha)\frac{\gamma}{1-\gamma}\frac{d\ln(z)}{d\ln(F)} = (1-\alpha)\frac{\gamma}{1 + \frac{(1-\theta K^2)(\gamma-1)}{1-\theta}}$$

1/ This can be calculated directly from the equation in footnote 1 on page 12.

2/ Moreover, from a general welfare theoretic point of view, it is difficult to see why a deterioration in the terms of trade should lead to a gain in welfare.

3/ Equation (19) shows how production increases with profitability.

The trade balance has to improve with an increase in foreign demand since the terms of trade, z, and thus production of exportables, x_p, increase. There is both a price effect, i.e., the increase in the terms of trade, and a volume effect, i.e., the increase in export production. The intuition behind these results is that the increase in foreign demand is satisfied partially by an increase in the supply of exports which in turn comes from two sources: a rise in export production and a fall in domestic consumption of exportables.

Although part of the increase in foreign demand, F, is chocked off by the "deterioration" in competitiveness, the volume of exports has to increase as can be shown by using the export demand function and equation (33):

$$(35)\quad \frac{d\ln(x_p-x)}{d\ln(F)} = 1 - \frac{1}{1-\Theta}\frac{d\ln(z)}{d\ln(F)} = \frac{\frac{1-\Theta}{\gamma-1} + K(1-K\Theta)}{\frac{1-\Theta}{\gamma-1} + (1-K^2\Theta)} < 1$$

This elasticity is less than one, although the direct elasticity of exports with respect to foreign demand is equal to one.

The effects of an increase in foreign demand with fixed nominal wages and exchange rates are summarized below:

Nominal exchange rate	Real exchange rate	Competitiveness*	Volume of exports	Volume of imports	Production (employment, profitability)	
s	q	1/z	$M_x(x_p-x)$	M_y y	home goods	exportables
-	-	↓	↑	↑	--	↑

* A rise in the terms of trade, z, means a deterioration in competitiveness.

2. Intermediate-run effects with full employment

In the intermediate run, i.e., with clearing labor markets, the effects of a rise in foreign demand are quite different from those in the short run, i.e., when labor markets do not clear. The constraint on total labor supply implies that the level of output in the exportables sector is a function only of real domestic expenditure: 1/

$$(36)\quad x_p = \left[\frac{\bar{L} - (\alpha RE)\,\alpha\, N^{1-\beta}}{M_x}\right]^{\frac{1}{\gamma}}$$

1/ See footnote 1 on page 15.

This implies that export production does not respond to foreign demand. The reason for this is that demand and production of home goods are determined only by real domestic expenditure which is assumed to be fixed. A constant proportion of the labor force is thus employed in the home goods sector, and the full-employment condition then implies that the labor force in the tradables sector cannot change. Moreover, since profitability is determined only by output, this leads to the conclusion that profitability in both sectors is not affected by the change in foreign demand.

With a given supply of exportables the increase in foreign demand has to lead to a change in the relative price of exportables, i.e., a change in competitiveness. The proportional change in competitiveness is equal to: 1/

$$(37)\quad \frac{d\ln(z)}{d\ln(F)} = (1-\Theta)\left[\frac{1}{K+1}\right] > 0$$

As before, domestic producers take advantage of the increase in foreign demand to raise their prices and thus "loose" competitiveness. However, the "loss" of competitiveness is not large enough to choke off any increase in the quantity of exports. Total exports are given by $M(x_p-x)$, since M, i.e., the member of firms in the tradables sector is fixed in the intermediate run, the effect of a change in foreign demand, F, can be calculated from the export demand function (13):

$$(38)\quad \frac{d\ln(M(x_p-x)}{d\ln(F)} = 1 - \left(\frac{1}{1-\Theta}\right)\left(\frac{d\ln(z)}{d\ln(F)}\right) = 1 - \frac{1}{K+1} > 0$$

The relative price of home goods in terms of exportables, $p_h/p_x \equiv q/z$, is determined by relative production costs which in turn are a function of output levels:

$$(39)\quad \frac{q}{z} = \frac{\beta\Theta}{\tau\gamma}\frac{h}{x_p}^{\beta-1}{}^{\gamma-1}$$

However, because production of (each typical specification of) home goods and exportables does not change with F, the ratio q/z is not affected by

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1/ The equation used to derive equation (22) implies:

$$0 = (1-\alpha)\frac{\beta\Theta}{\tau\gamma}\left(\frac{\alpha}{\bar{N}}\right)^{\beta-1} RE^{\beta} - [M + z^{\frac{-\theta}{\Theta-1}}][x_p - Fz^{\frac{1}{\Theta-1}}]$$

Taking into account that x_p is constant, the elasticity of equation (35) can be calculated directly.

a change in F. Thus, an increase in foreign demand has the same effect on the real exchange rate, q, as on competitiveness, z.

The effect on the trade balance can be described by using an expression for the trade balance that is substantially equivalent to equation (21):

$$(40) \quad TB/E = x_p M(z/q)/RE - (1-\alpha)$$

In this situation, an increase in foreign demand deals does not affect the trade balance since none of its determinants change. As already noted, both export production and the relative price of exports in terms of home goods are not altered by a change in foreign demand. Thus, if labor markets clear, an increase in foreign demand does not lead to an improvement in the trade balance. However, there are offsetting changes in exports and imports. The substitution between exportables and importables in domestic consumption as described in equation (10) implies that the ratio of the consumption (of each typical specification) of importables to exportables is determined by the terms of trade: $(y/x) = z^{1/(1-\Theta)}$. Using the results of equations (37) and (38), this implies that the proportional increase in the volume of imports is equal to:

$$(41) \quad \frac{d\ln(y)}{d\ln(F)} = \frac{K^2}{1-K^2} + \frac{1}{K+1}$$

The rise in the terms of trade, caused by the shift in foreign demand, thus leads to a shift in (domestic) consumption towards importables. The resulting induced increase in imports is just large enough to offset the impact of the increased value of exports on the trade balance. Gross trade expands since the volumes of both exports and imports increase.

The effects of an increase in foreign demand with full employment can now be summarized as follows: 1/

Nominal exchange rate	Real exchange rate	Competitiveness*	Volume of exports	Volume of imports	Production (employment, profitability)	
					home goods	exportables
s	q	1/z	$M_x(x_p-x)$	M_y y		
↓	↑	↓	↑	↑	--	--

* A rise in the terms of trade, z, means a deterioration in competitiveness.

1/ To make the presentation comparable to the preceding one, it is assumed that nominal wages are constant.

A comparison of these results with those obtained for the short run reveals that an increase in foreign demand will have different effects depending on whether the labor market can adjust to this disturbance. Profitability and employment in the exportables sector increases only if the labor market does not adjust and thus employment varies. If the labor market does not adjust so that employment varies, the real exchange rate is not affected by foreign demand, whereas if labor markets adjust so that full employment is maintained, the real exchange rate rises by the same proportion as the competitiveness index. 1/

3. Long-run effects

Since it is assumed that full employment is maintained in both the long and intermediate run, the output of exportables or home goods is not affected in either the intermediate or long run by changes in foreign demand. As a result, the long-run effects of an increase in foreign demand are exactly the same as the intermediate-run effects. If production is not affected in the short run, the number of firms in the two sectors will not have to adjust in the long run either. Therefore, the increase in foreign demand affects only relative prices and exports, even if it persists in the long run. Increases in export demand thus do not affect the trade balance and growth of a country in which there is full employment.

The term "a loss of market shares" is often used to describe a situation in which the volume of exports does not grow as fast as foreign demand. 2/ But the results of this section imply that an increase in foreign demand, F, will not lead to an equiproportional increase in exports, even in the long run. This occurs in spite of the fact that the export demand function (see equation (13)) has a unitary elasticity with respect to foreign demand. This "loss" of market shares is due to the general equilibrium effects which imply that an increase in F leads to a relative price change, i.e., a "loss" of competitiveness, which in turn reduces exports. Since competitiveness deteriorates by more in the full employment case, the loss of market shares would be stronger in the full employment case (intermediate and long run) than in the fixed wages and exchange rate case. The observed correlation between foreign demand and exports (and the terms of trade) could thus vary over time depending on the state of employment in the economy. This general equilibrium relationship between foreign demand and competitiveness is usually not

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1/ It is not apparent from these tables, but it can also be shown that the loss of competiveness is stronger in the full employment case because there is no increase in export production and thus a smaller increase in exports. The price of exportables, therefore, has to rise by more to equilibrate demand and supply of exportables.

2/ Foreign demand, is usually represented by GNP growth in the rest of the world, weighted by export shares. But this definition should capture the same effects as the parameter F in the export demand function.

taken into account in the estimation of export demand functions. 1/ This should lead to parameter estimates for foreign demand and for competitiveness indicators that are biased.

V. Exchange Rate Policy with Rigid Wages

In this section, the exchange rate is assumed to be a policy instrument and nominal wages are again assumed to be fixed in the short run. The specific policy action analyzed here is a 1 percent devaluation, i.e., a 1 percent increase in s. 2/ The purpose of this section is thus to calculate the short-run effects of a devaluation (or the equivalent monetary policy) on competitiveness, profitability, exports, and imports.

Since output of the nontradables is given by $h = \alpha RE/N$ and the devaluation is assumed not to affect real expenditure, output and profitability in the nontradables sector do not change as a result of the devaluation. At a given level of the output of nontradables and given wage rates, the price of nontradables is fixed by equation (15). For the real exchange rate, this implies that:

$$(42) \quad q = \frac{Ph}{s} = \frac{\beta\bar{w}}{\tau s}\left(\frac{\alpha RE}{N}\right)^{\beta-1}$$

and thus

$$(43) \quad \frac{d\ln(s)}{d\ln(q)} = -1$$

This shows that, given real expenditure and nominal wages, a 1 percent nominal devaluation leads to a 1 percent real devaluation.

However, one aim of a devaluation is typically to stimulate competitiveness and output in the tradables sector. The effects on the competitiveness indicator z can be found from equation (18): the elasticity of the competitiveness indicator with respect to change in the nominal exchange rate is equal to:

1/ It is also not taken into account when these equations are used for policy analysis and forecasting purposes.

2/ As in the previous sections, the assumption of fixed wages implies that the labor market no longer clears, and total employment is determined by labor demand. For countries operating under a flexible exchange rate, the results of this section can be interpreted as showing the effects of a change in monetary policy that leads to a 1 percent depreciation of the exchange rate.

$$(44)\quad \frac{d\ln(z)}{d\ln(s)} = -\frac{K + \frac{1}{\gamma-1}}{\frac{1}{1-\theta}(1-K)(1+\theta K) + K + \frac{1}{\gamma-1}} > -1$$

This elasticity is smaller than one (in absolute value) i.e., the gains in competitiveness is smaller than the devaluation. The reason for this is that gains in competitiveness leads to an increase in the production of exportables and as producers of exportables move along their supply curve they have to increase their prices. The nominal devaluation would translate fully into a gain in competitiveness only if the supply of exportables is infinitely elastic, i.e., if $\gamma = 1$. 1/

The devaluation also leads to an increase in profitability in the exportables sector as can be shown by writing $p_x/\bar{w} = (p_x/s)(s/\bar{w}) = z(s/\bar{w})$. Since nominal wages are fixed this implies:

$$(45)\quad \frac{d\ln(p_x/w)}{d\ln(s)} = \frac{d\ln(z)}{d\ln(s)} + 1$$

$$= \frac{(1-K)(1+\theta K)}{(1-K)(1+\theta K) + (1-\theta)[K + 1/(\gamma-1)]} < 1$$

Again the "pass-through" of the devaluation on export prices is less than complete because the elasticity in equation (45) is less than one. This increase in profitability is another aspect of the increase in the production of exportables since profitability and output are linked by $p_x/w = (\gamma/\theta)(x_p)^{\gamma-1}$, and thus $d\ln(x_p) = 1/(\gamma-1)d\ln(p_x/w)$.

The result of equation (44) can also be used to determine the effectiveness of a devaluation, which is often measured by the "split" 2/ between increased competitiveness (i.e., the fall in z) and increased

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1/ The results of equations (40) and (41) seem to suggest that for a given country the effects of devaluation on the real exchange and competitiveness should always be the same. However, observed devaluations might differ in their effects because they are usually accompanied by expenditure measures which have their own impact on the real exchange rate and competitiveness.

2/ In this framework, the gain in competitiveness due to a devaluation and thus the split between competitiveness and profitability is determined by the parameters of the supply and demand functions and the relative size of the country. For any given country, this split should thus be constant. However, the split that can be observed for various devaluation episodes might vary because wages respond to devaluations in varying degrees, and also because devaluations are often anticipated so that exporters take them into account in their list prices even before the devaluation occurs.

profitability (i.e., the increase in p_x/w). A devaluation is usually considered more effective if it leads to a larger increase in competitiveness, i.e., if exporters do not raise their domestic currency prices. However, this reasoning does not take into account the fact that production of exportables (at given wages) is an increasing function of the price of exportables. For a given value of the elasticity of the output of tradeables with respect to labor input, γ, the greater is the gain in competitiveness, the lower will be the increase in output. The reason for this is that exporters have to move along the demand curve for exports; if this demand curve is steep, i.e., if the absolute value of $1/(\Theta-1)$ is low, equation (44) indicates that the gain in competitiveness is large, but at the same time equation (45) indicates that in this case the gain profitability, and hence in production, is small. If the purpose of a devaluation is to stimulate production in the exportables sector, the devaluation should be considered more effective if the gain in competitiveness is small because this means that domestic producers of exportables are able to increase prices which enables them to increase production. But if the purpose of the devaluation is to stimulate exports, the devaluation should be considered effective if the gain in competitiveness is large because this means a large increase in exports.

However, an increase in exports is usually not the final purpose of a devaluation; devaluations are often used to reduce deficits in the trade balance. Writing the trade balance as the difference between production and expenditure of tradables shows immediately that an improvement in the balance of trade depends on an improvement in the output of tradables. Using the results of equations (44) and (45) the change in the trade balance as a proportion of total expenditure is equal to:

$$(46)\quad \Delta(TB/E) = (1-\alpha)\gamma[\Delta(x_p)/x_p]$$

$$= (1-\alpha)\left(\frac{\gamma}{\gamma-1}\right)\left[\frac{(1-K)(1+\Theta K)}{(1-K)(1-\Theta K) + (1-\Theta)[K + 1/(\gamma-1)]}\right]$$

This shows that the smaller the gain in competitiveness, i.e., the larger the rise in the price of exports in response to a devaluation, the stronger the improvement in the trade balance. 1/

1/ The trade balance improves because output of tradables goes up and the demand for tradables does not change since overall expenditure is not affected. However, there is a shift in the composition of the consumption of tradables, away from importables and towards exportables because the relative price of exportables falls. Imports fall and domestic consumption of exportables increases.

A devaluation should therefore be considered more effective if the observed gain in competitiveness is small (and thus the observed gain in profitability is large) irrespective of whether the purpose of the devaluation is to stimulate production or to improve the trade balance. 1/

The effects of a devaluation with fixed wages can be summarized as follows:

Nominal exchange rate	Real exchange rate	Competitiveness*	Volume of exports	Volume of imports	Production (employment, profitability)	
s	q	1/z	$M_x(x_p-x)$	M_y y	home goods	exportables
↑	↓	↑	↑	↓	--	↑

* A rise in the terms of trade, z, means a deterioration in competitiveness.

VI. Concluding Remarks

This paper has discussed some issues concerning the concepts of profitability and competitiveness. While these concepts are difficult to define in the context of homogenous products and constant returns to scale, the existence of differentiated products and increasing returns to scale allows for a rigorous definition of competitiveness and profitability. Competitiveness has often been defined in terms of the price of domestic exportables relative to the price of foreign exportables. This relative price can vary only if domestic and foreign exportables are differentiated products. In turn, profitability has typically been defined as the ratio of prices to wage rates, which is often called the profit margin in applied work.

While empirical analyses of the determinants of trade balances and expert performance have often taken competitiveness or profitability as predetermined variables, this paper argues that these variables are affected by general macroeconomic developments and cannot be taken as exogenous even in the short run. The paper, therefore, considers the effects on competitiveness and profitability of an increase in domestic demand, an increase in foreign demand, and a devaluation.

1/ A devaluation (with fixed wages) has often been characterized as a "beggar-thy-neighbor" policy in that it leads to an increase in exports at the expense of the rest of the world. In a certain sense, this is true in this framework since imports, M_y y, from the rest of the world have to fall.

It is shown that an increase in real domestic demand will lead to a real appreciation and a loss of competitiveness. If wages and the nominal exchange rate are kept fixed and there is less than full employment, it will also lead to an increase in profitability in the home goods and tradables sectors. If labor markets clear and there is full employment, however, profitability will fall in the exportables sector and rise in the home goods sector.

The effects of an increase in foreign demand will likewise depend on whether labor markets clear or wages and the exchange rate are rigid. With full employment, profitability in both sectors will not change, competitiveness will deteriorate and there will be no change in the trade balance. However, with rigid wages and exchange rates (and thus variable employment), profitability in the export sector will go up, and competitiveness will deteriorate less than in the full employment case. The result that competitiveness deteriorates as foreign demand increases shows that policies that are based on observed movements of competitiveness might be misled. Indeed, in this situation, domestic producers do not "lose" competitiveness but take advantage of favorable market conditions to raise their prices relative to those of their competitors. Another corollary of this result is that the general equilibrium elasticity or exports with respect to foreign demand is lower than the direct or partial equilibrium elasticity since part of the increase in foreign demand is chocked off by the induced deterioration in competitiveness. Moreover, since the deterioration in competitiveness induced by an increase in foreign demand differs depending on whether wages and the exchange rate are rigid or full employment is maintained, the general equilibrium elasticity of exports with respect to imports should vary over time.

A devaluation of the nominal exchange rate with rigid wages will imply an equiproportional real depreciation and a less than equiproportional gain in competitiveness. Profitability in the export sector will increase along with exports. If the effectiveness of a devaluation is measured by the induced increase in exports or the induced improvement in the trade balance, it is also shown that a devaluation is more effective if the observed gain in competitiveness is small.

List of Symbols

Parameters:

α: Share of expenditure going to home goods

β, γ: Inverse of the elasticity of output with respect to input of labor in the home goods and tradable goods sectors, respectively

τ, θ: Inverse of the substitutability among different specifications of home goods and tradable goods, respectively

Variables:

h (=hp): Domestic consumption (equals production) of each specification of home goods

x, x_p: Respectively, domestic consumption and domestic production of each specification of tradable, exportable goods

p_n, p_x, p_y: Nominal, domestic currency prices of, respectively (each specification of) home goods, exportables, and importables

s: Exchange rate, domestic currency per unit of foreign currency

w, r: Factor prices of, respectively, labor (=wage rate) and capital (=interest rate)

l_h, l_x: Labor used in each typical firm producing, respectively, home goods and exportables

$\bar{l}$: Total labor supply of home country

k_h, k_x: Capital used in each typical firm producing, respectively, home goods and exportables

N, M: Number of firms in, respectively, the home goods and exportables sectors

K: Defined as x/xp, i.e., the proportion of the production of (each typical specification of) exportables consumed at home

E: Total nominal domestic expenditure

RE: Total real domestic expenditure

TB: Trade balance in terms of domestic currency

F: Index of foreign demand

q: Real exchange rate defined as the relative price of home goods in terms of importables

z: Competitiveness index, defined as the terms of trade, i.e., the relative price of exportables in terms of importables

APPENDIX II

To determine the shares of total labor allocated to each sector in the long run, it is convenient to start with the equilibrium condition on the market for nontradables. Since the zero profit condition implies that total income is equal to total cost (and assuming all income is spent), equation (14) can be rewritten as:

$$(A.1) \quad \alpha E = \alpha [w\bar{L} + r(N\bar{K}_h + M_X\bar{K}_X)] = NHp_h$$

This can be simplified by denoting the total capital stock of the economy by $\bar{K}$ (capital is nonspecific before bolted down in one sector) and by using the supply function of nontradables. This leads to

$$(A.2) \quad \alpha [\bar{L} + r/w(\bar{K})]\frac{\tau}{\beta} = N\ell_h$$

Similarly equilibrium on the market for tradables implies, at a zero trade balance

$$(A.3) \quad (1-\alpha)[w\bar{L} + r\bar{K}] = M_X x_p p_X$$

This can be simplified to

$$(A.4) \quad (1-\alpha)[\bar{L} + (r/w)\bar{K}]\frac{\theta}{\gamma} = M_X \ell_X$$

Summing equations (A.2) and (A.4) implies

$$(A.5) \quad \bar{L} = \bar{L}[\frac{\tau}{\beta}\alpha + \frac{\theta}{\gamma}(1-\alpha)] + \bar{K}(\frac{r}{w})[\frac{\tau}{\beta}\alpha + \frac{\theta}{\gamma}(1-\alpha)]$$

This can be solved for the (inverse of the) wage rental ratio:

$$(A.6) \quad \frac{r}{w} = \frac{\bar{L}[1 - [\frac{\tau}{\beta}\alpha + \frac{\theta}{\gamma}(1-\alpha)]]}{\bar{K}[\frac{\tau}{\beta}\alpha + \frac{\theta}{\gamma}(1-\alpha)]}$$

APPENDIX II

For the closed economy, with $\bar{L}$ and $\bar{K}$, equation (A.6) determines the wage rental ratio. For a small open economy, r is given by the world capital market and determines (given τ) the amount of capital used in the home economy by whomever. Whatever the interpretation of equation (A.6), this equation can be used to determine the share of labor going to the nontradables sector. Substituting equation (A.6) into equation (A.2) yields:

$$(A.7) \quad N\ell_h = \frac{\tau}{\beta}\alpha\left\{\bar{L} + \bar{L}\frac{\left[1 - \left(\frac{\tau}{\beta}\right)\alpha + \frac{\theta}{\gamma}(1-\alpha)\right]}{\frac{\tau}{\beta}\alpha + \frac{\theta}{\gamma}(1-\alpha)}\right\}$$

or

$$(A.8) \quad N\ell_h = L\,\frac{1}{1 + \frac{\theta\beta}{\gamma\tau}\frac{(1-\alpha)}{\alpha}} \equiv \bar{L}\phi$$

Appendix III

To determine the relationship between the ratio of domestic consumption to domestic production of exportables, x/x_p, and the relative number of firms in the tradables sector it is convenient to start with the trade balance equilibrium condition.

$$(A.9) \quad p_x M_x (x_p - x) = p_y M_y y$$

Using equation (A.10), this can be simplified to:

$$(A.10) \quad \frac{M_x}{M_y} = \left[\frac{x_p}{x} - 1\right]^{-1} z^{\frac{\theta}{\theta-1}}$$

By a suitable choice of F, it is possible to determine that $z = 1$, using the definition $K \equiv x/x_p$, equation (A.10) can be rewritten as:

$$(A.11) \quad \frac{M_x}{M_y} = \frac{K}{1-K}$$

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