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"WAGE PROBLEMS" AND THE SHORT-RUN EFFECTS OF OPENING A SMALL ECONOMY: A GEOMETRICAL ANALYSIS

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FOREWORD

This Collaborative Paper is one of a series embodying the outcome of a workshop and conference on *Economic Structural Change: Analytical Issues*, held at IIASA in July and August of 1983. The conference and workshop formed part of the continuing IIASA program on Patterns of Economic Structural Change and Industrial Adjustment.

Structural change was interpreted very broadly: the topics covered included the nature and causes of changes in different sectors of the world economy, the relationship between international markets and national economies, and issues of organization and incentives in large economic systems.

There is a general consensus that important economic structural changes are occurring in the world economy. There are, however, several alternative approaches to measuring these changes, to modeling the process, and to devising appropriate responses in terms of policy measures and institutional redesign. Other interesting questions concern the role of the international economic system in transmitting such changes, and the merits of alternative modes of economic organization in responding to structural change. All of these issues were addressed by participants in the workshop and conference, and will be the focus of the continuation of the research program's work.

Geoffrey Heal
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ABSTRACT

For a small country we analyze the effects of opening for trade on (sectoral and national) employment, production, profit and labor income, and on the country's welfare. We assume the sectoral capital inputs to be fixed. Moreover, the term 'short-run' denotes a time horizon in which wage rates have not yet reached their general competitive equilibrium values. We distinguish between several forms of wage rigidities (sectoral or general; downward or complete; in terms of different commodities and in terms of a constant-utility combination of commodities; rigidity of wage levels or sectoral wage differential). We try to draw a connection to the theory of temporary equilibrium with quantity rationing.

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"... it could not be claimed that quantity-adjusted temporary equilibria will always depict reality better than price-adjusting ones. However, the opposite is not universally true, either." (Dixit, 1978, p. 404)

1. INTRODUCTION

In this paper the implications for a small country of opening for trade are analyzed under varying assumptions concerning wage flexibility. As well as the traditional case of a unique, perfectly flexible wage rate we consider cases of downward or complete, sectoral or general rigidity of the real wage rate in terms of any of the commodities. Furthermore, we analyze the case where there is a differential between sectoral nominal wages.

The method of analysis follows that of Haberler (1950), Hagen (1958), and Johnson (1965) insofar as it starts from a position of no trade and then introduces free trade. In addition to the welfare effects of trade we study the consequences for sectoral output levels and thus for the production structure. Moreover we shall discuss the effects on sectoral and total employment levels, including cases of excess demand in the labor market.

In order to make clear the significance of labor market distortions, we shall use a graphical illustration that seems particularly apt for our purposes but, as far as we know, has not previously been used in the present context. Furthermore, we try to make a first step towards using instruments of so-called disequilibrium (or neokeynesian, fixed-price) analysis in the pure theory of international trade, e.g., rationing schemes, quantity rationing in the labor market, and the resulting spill-over effects in the commodity markets.

As in macroeconomic monetary analysis of open economies (which we interpret as a less long-run approach than the standard pure trade model), we do not consider explicitly the sectoral capital inputs. In contrast to this procedure, previous literature on wage problems in the pure theory of international trade has mostly dealt with the two-factor case. An early exception is Hagen (1958) who treats the Ricardo-type, fixed-input coefficient case. More recently, Neary (1982) views the sectoral capital stocks as fixed in the short run; he then analyzes the effects of a change in the terms of trade for a small open economy whose wage rate in terms of one of the two commodities is fixed for the whole economy. We shall treat this case in Section 6.

With the exception of the sectoral differential wage rates case discussed in Section 8, the economy initially is not only closed, but is also in a general competitive equilibrium. This means in particular that there is only one price in every market and that there is no quantity rationing at existing prices; for detailed presentations of the conditions necessary for a general competitive equilibrium see Meyer (1983, pp. 43,47), Negishi (1972, p. 16), and Schumann (1980, pp. 191-200).

In the next section the basic framework is developed. Section 3 analyzes the effects of opening for trade when there is a unique wage rate which is perfectly flexible. In Section 4 some general and introductory remarks are made concerning our subsequent analysis of wage problems. Cases of downward rigidity (at the pretrade level) of the real wage rate are analyzed in Section 5. Complete rigidity in terms of the export-competing commodity is discussed in Section 6, while complete rigidity in terms of the importable commodity is treated in Section 7. Each of these sections distinguishes between general and sectoral rigidity, where sectoral rigidity in terms of commodity i means rigidity only in sector i. In Section 8, where we analyze the case of a differential between sectoral nominal wages, the distortion is assumed to exist already in the pre-trade situation. Finally, Section 9 summarizes the main findings, draws some conclusions, and indicates lines of further research.

2. FRAMEWORK OF THE ANALYSIS

The framework utilized is that of the most simple trade model. Its supply side can be characterized by the following assumptions:

- there are only two commodities, X_1 and X_2, both of which are, in principle, tradeable. Each of them is produced by one firm which represents at the same time one of the two domestic production sectors;
- there is only one factor of production, labor L, whose sectoral imports L_1 and L_2 may be varied;
- in order to avoid mathematical problems connected with Ricardo's fixed-input coefficient model, we assume diminishing marginal returns for this factor in each sector. This may be attributed to the fact that there also exist other factors of production whose sectoral inputs are, however, fixed in the short run; we do not take these factors into consideration explicitly. (See Dixit and Norman (1980, pp. 38-39) on the mathematical problems arising in a Ricardo-type model and on the interpretation of diminishing returns in a one-factor model; on the latter point see also Neary (1978, pp. 489-490);
- labor supply is given exogenously and thus does not react to price changes ($L^s = \bar{L}^s$). This is in accordance with the standard trade model. As the present paper should be understood as describing a more short-run analysis than that model (in the sense that the effects of the opening of trade are analyzed when wages have not yet reached their new general competitive equilibrium values), the independence of the labor supply from the other variables of the model seems to be even more justified than in the traditional model. (See Helmstädter (1979, pp. 98-99) on the relevance of the time horizon for the price elasticity of the labor supply);
- there is perfect intersectoral, but no international mobility of labor;
- all economic units exhibit competitive behavior in product markets.

As mentioned before, the supply side is completed by alternative assumptions concerning wage flexibility. On the demand side we do not distinguish explicitly between different households, but assume that the behavior of the household sector is identical (except for the levels of the quantity variables) to that of a representative household. We assume that the indifference curves describing its preferences can be interpreted as social indifference curves. As is quite common in the analysis of factor market distortions in the pure theory of international trade, the demand side is then represented by a set of social indifference curves which determine the demand quantities of both commodities, given the price ratio and the production quantities; see, e.g., Batra and Pattanaik (1970, p. 639). Given a production point in the two-commodity diagram, the price line through this point can be viewed as the country's overall budget constraint, stating that the sum of expenditures for both commodities just equals the sum of labor and profit income implied by the production point. It should be noted that we assume a completely atemporal decision situation for both households and firms, i.e., there is no asset making it possible to transfer purchasing power into the future nor do we allow for storage; thus we also neglect savings.

The following figure is intended to illustrate the idea that budget lines below the full employment line reflect rationing of the household in the labor market, i.e., the demand quantities on such lines reflect the spill-over effect from the labor market. Therefore they are denoted as 'effective' demand quantities, in contrast to 'notional' (or 'Walrasian') quantities which only depend on prices. This distinction is one of the central features of the disequilibrium theory mentioned above and was called the 'dual decision hypothesis' by Clower in his pioneering article; see Clower (1963, pp. 24-26). For a lucid analysis of household behavior from the point of view of disequilibrium theory see Meyer (1983, pp. 84-87, 125-129, 139-145, and 161-176) who treats the one-commodity, one-factor case with and without money.

In Figure 1, point A represents a full-employment production point. Any consumption quantities which lie on the budget line passing through point A are called 'notional' because they are not subject to any quantity rationing. (Note that in a small open economy, there are no specific quantity constraints in the commodity market for any domestic agent; instead the overall trade balance equilibrium condition only defines a range of admissible combinations for the whole of commodity supply and demand quantities: see Dixit (1978, p. 394) and Neary (1980, pp. 406-409).

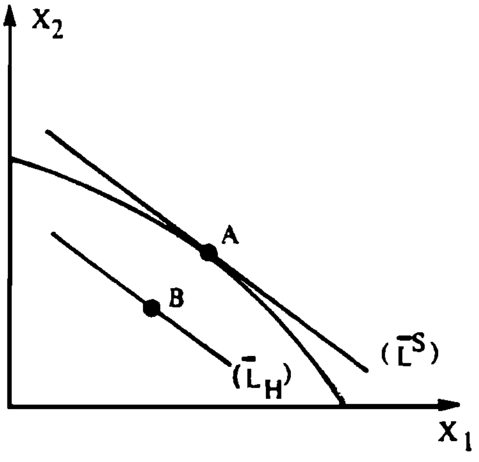

FIGURE 1.

If there is unemployment, the production point lies below the transformation curve, say at point B. Because of the reduced income, the budget line lies below the line through point A; it is characterized by the employment level $\bar{L}_H < \bar{L}^s$, where the subscript H indicates that it is the household that is rationed in the labor market. Consumption points on this line are called 'effective' because they reflect the quantity rationing spill-over effect from the labor market.

It should be noted that the position of the budget line depends on labor *and* profit income, both of which depend on the employment level. Assuming that the household takes the budget line through the production point B as a basis when choosing the optimal consumption quantities implies that it correctly perceives the profit income connected with point B. More precisely, we assume consistent profit expectations, i.e., profit income expected by the household is equal to the actual profits of the firms. Thus the reduction of the employment level from $\bar{L}^s$ to $\bar{L}_H$ causes the budget line to shift not only because of the reduced labor income, but also because of the induced change of correct-profit expectations.

Restricting the analysis to equilibria with consistent profit expectations allows us to avoid problems concerning the existence of temporary equilibria in later sections. Furthermore, deviations of a given temporary equilibrium from general equilibrium can be attributed entirely to wage problems. For a thorough discussion of the relationship between temporary equilibria and consistent profit expectations see Meyer (1983, pp. 132-134, 156-160).

With both the consumption and production points *on* the country's budget line, its balance of trade is in equilibrium. With both points *identical*, the country does not engage in international trade.

As there is no asset in our model, we do not allow for any trade balance disequilibrium.

3. UNIQUE, PERFECTLY FLEXIBLE WAGE RATE: GENERAL COMPETITIVE EQUILIBRIUM

Figure 2 gives a graphical illustration of both the pre-trade and the free-trade general equilibria, with the points for the latter indicated by circles. In the figure Parts II and IV show the sectoral production functions, both of which exhibit diminishing positive returns of the only variable factor of production, labor; labor input in the first (second) sector is denoted as L_1 (L_2). Parts I and VI show the corresponding marginal productivity schedules, which are drawn as straight lines for simplicity only. Part V represents the equilibrium condition for the labor market, with the exogenous labor supply quantity $\bar{L}^s$ indicated by the intercepts on both the L_1 and the L_2 axes. Part VII reflects the fact that in a perfectly competitive economy the value marginal product of labor must be equal in all sectors and therefore the same must be true for the marginal products in terms of any commodity; assuming profit-maximizing behavior on the part of the firms, these marginal products equal the real wage rate in terms of the respective commodity (w/p_1 , w/p_2). In part III the supply side is summarized in the production possibility curve. Its tangency point with a social indifference curve (point A) gives the pre-trade, general competitive equilibrium amounts of both commodities. The corresponding points in the other parts of the figure indicate the implied sectoral inputs of labor and its marginal productivities. The pre-trade ratio of the commodity prices p_1/p_2 is represented by the tangent of the angle α_1 in part VII.

When the economy is opened for trade, the domestic country adopts the international price ratio, which is assumed to be smaller than the pre-trade ratio; in part VII the new ratio is indicated by the tangent of the angle α_2. With the wage rate unique and perfectly flexible, we find the usual effects of the introduction of free trade (in Figure 2, the free-trade points are connected by dashed lines):

- from part II it can be seen that output and employment are raised in the second sector, i.e., in the sector whose relative commodity price in terms of the other sector's product has increased. On the other hand, levels of employment and production are reduced in the first sector, as can be seen from part IV;
- in part III, the new production quantities are summarized in point B. Comparing B with the pre-trade production point A shows the change of the production structure X_2/X_1 in favor of the second sector;
- profit income in the second sector in terms of its output $(G_1/p_1 = X_1 - w/p_1 \cdot L_1)$ is given by the intercept of the tangent to a given production point in part II (in order not to overload the figure, no such tangents are actually drawn). It can be easily seen that the intercept of the tangent for the new production point exceeds that for the pre-trade point. Moreover, multiplying the increased profit income in terms of X_2 by the inverse of the ratio p_1/p_2 shows that the second sector's profit income has gone up even more in terms of X_1. By similar reasoning it can be seen with the help of part IV that the opposite results hold for the first sector;
- in both sectors, the marginal products of labor and thus the real wage rates have gone up (down) in terms of $X_1(X_2)$, as can be seen from parts I, VI, and VII. With the overall employment level constant, the same is true for labor income in terms of $X_1(X_2)$;

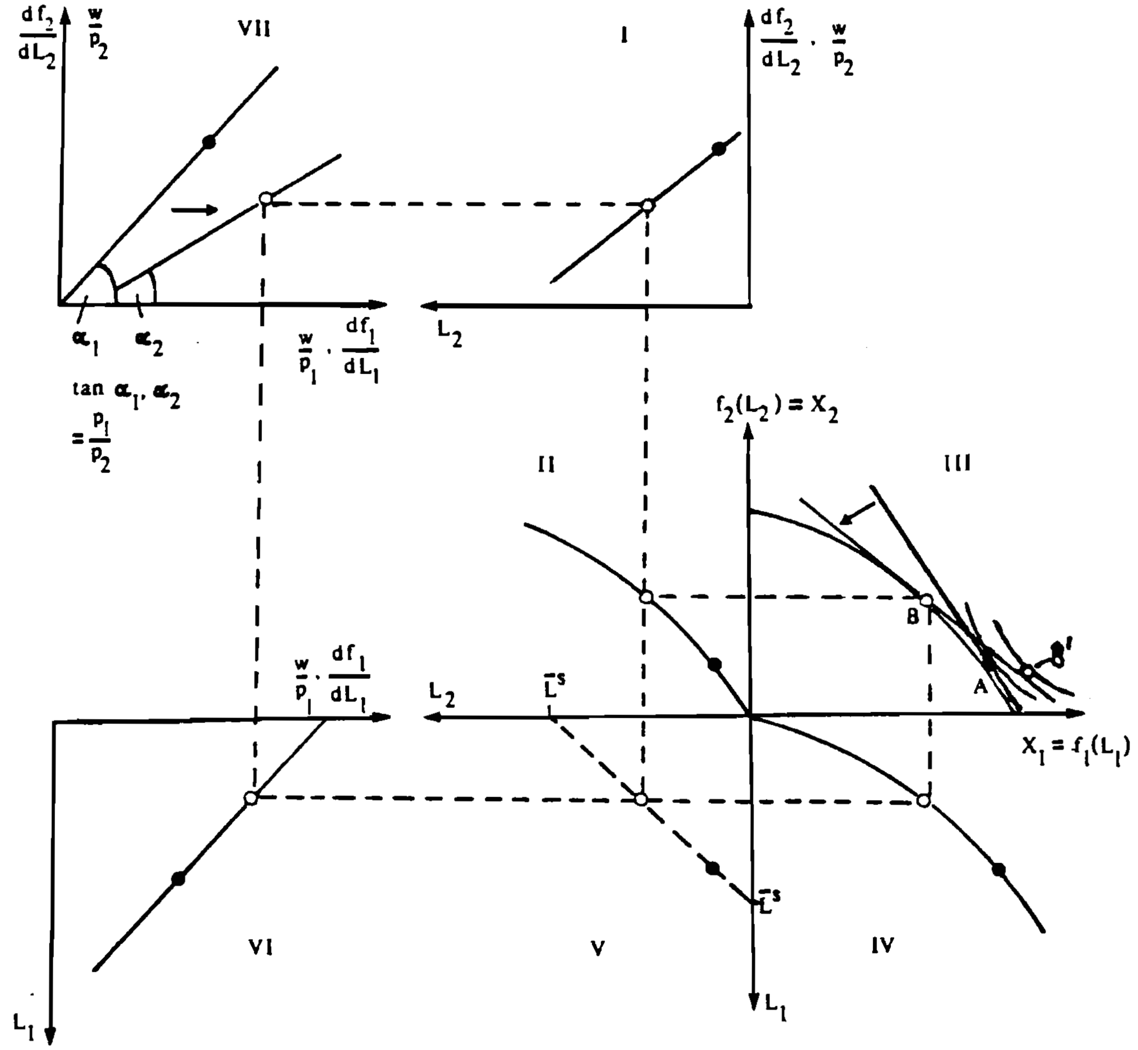
$\frac{df_2}{dL_2}$
$\frac{w}{p_2}$
VII
I
$\frac{df_2}{dL_2} \cdot \frac{w}{p_2}$
α_1
α_2
$\frac{w}{p_1} \cdot \frac{df_1}{dL_1}$
L_2
tan α_1, α_2
$= \frac{p_1}{p_2}$
$f_2(L_2) = X_2$
II
III
B
A
δ'
$\frac{w}{p_1} \cdot \frac{df_1}{dL_1}$
L_2
$\bar{L}^s$
$X_1 = f_1(L_1)$
$\bar{L}^s$
VI
V
IV
L_1
L_1

FIGURE 2.

- -- part III shows that, in contrast to the direction in which production has specialized, demand for X_1 is raised while that for X_2 is reduced. This leads the domestic country to export X_2 and to import X_1.
- -- part III shows that opening for trade permits the economy to reach a higher welfare level.

4. "WAGE PROBLEMS" AND EQUILIBRIUM: SOME PRELIMINARY REMARKS

In the general competitive equilibrium analysis we implicitly made the assumption that the wage rate (and in the closed economy the commodity prices too) adjusts so quickly that transactions different from those in general equilibrium, i.e., transactions generated by other wage rates than those in general equilibrium, can be neglected. We replace this assumption now by the postulate that there are wage rigidities of one sort or another in a given period of time. Though we call this the short-run period we assume that the transactions taking place during the period cannot be neglected. It should be noted that the postulate of fixed wages is a simplified version of a more realistic model in which wages change at every point in time but are nevertheless so sluggish that considerable amounts of all goods are exchanged before a general equilibrium is reached.

We shall demonstrate that, in spite of sluggish wage adjustment, an equilibrium may exist, i.e., such a constellation of the remaining endogenous variables that the plans of the agents are consistent and therefore can be carried out. But as wage rates can be "wrong" in the sense of differing from those in a general competitive equilibrium, the equilibrium will be removed by induced changes of wage rates, which -- in the terminology of temporary equilibrium theory -- are the 'slow' variables in our model: rationing on the labor market will lead to changes in the absolute levels of real and nominal wages, and a differential between sectoral wage rates will induce labor movements between sectors, which will in turn tend to equalize the wage rate across sectors. Thus the equilibrium is only a temporary one. In the present paper, however, only the temporary equilibrium, not the convergence of the economy towards a new general competitive equilibrium, will be analyzed; the convergence may be thought of as a sequence of temporary equilibria, each of which is valid for another given wage rate or wage differential.

Given the effects on real wage rates of opening the economy for trade described in Section 3, we can predict which kinds of "wage problems" will prevent the economy from reaching the free-trade general equilibrium:

- downward or complete rigidity (either general or in the second sector) of the real wage rate in terms of the second commodity, i.e., that commodity whose production in general equilibrium would increase and which is exported;
- complete rigidity of the real wage rate in terms of the first commodity;
- a differential between nominal sectoral wage rates and thus, given any price ratio p_1/p_2, between real sectoral wage rates in terms of any of the commodities.

5. DOWNWARD RIGIDITY OF THE REAL WAGE RATE

5.1. Downward Rigidity in Terms of the Export-Competing Commodity

The analysis of the following Subsection 5.1.1 (below) is based to some extent on the following contributions, which differ, however, in one way or another from our basic assumptions: Magee (1973, pp. 4-6) treats the one-factor, fixed-input coefficient case. Johnson (1965, pp. 14-18) and Chacholiades (1978, pp. 522-524) discuss the two-factor case for a small economy, while Brecher (1974) does the same for the large country. Schweinberger (1978) analyzes the n-factor, n-commodity case for a small country.

The analysis presented in Subsection 5.1.2 partly draws on the work of Johnson (1969, pp. 600-603), who analyzes the consequences of sectoral downward rigidities of the real wage rate for a two-factor, closed economy.

None of these authors, however, uses our graphical exposition.

5.1.1. *General Rigidity*

We analyze this case with the help of Figure 3 where the minimum real wage rate in terms of X_2 is drawn as a horizontal line in part I, indicating that the free-trade level must not fall below the pre-trade level. Throughout the figure, the pre-trade (free-trade) general competitive positions are indicated by solid points (circles), whereas the temporary equilibrium positions for general wage rigidity are marked by rectangles.

With the real wage rate in terms of X_2 rigid downward, L_2 and X_2 will not be raised above its pre-trade level. Moreover, part VII shows that because of the general validity of the minimum wage, we now have the real wage rate in terms of X_1 exceeding that in the free-trade, general competitive equilibrium case (see the point marked as a rectangle). Therefore L_1 and X_1 are reduced even more than in that case; in our graphical example they are set as zero, as can be seen in part VI. The effects on the sectoral production quantities are indicated by the position of rectangle C in part III. Comparing C with free-trade position B shows that the structural change in favor of the export-competing commodity X_2 is stronger than in the flexible-wage case.

Part VII shows that any ratio p_1/p_2 smaller than the international terms of trade implies an even higher minimum wage in terms of X_1. Thus for all ratios smaller than that in B the domestic production quantities are always given by C in part III. For ratios exceeding that in B, but smaller than the pre-trade ratio in A, production takes place on a corresponding point on the horizontal line connecting C and A. For ratios equal to or greater than that in A, the minimum wage is no longer binding, and the free-trade production point lies on the segment of the production possibility curve below point A. Thus the transformation curve is now given by this segment and the horizontal line connecting C and A. This is reproduced in Figure 4. This transformation curve might be called a 'market transformation curve' because its particular form is generated by factor market distortions. The usual production possibility curve is called a 'technical transformation curve' in this terminology; see Magee (1973, p. 16). It should be clear, however, that both are the outcome of market processes which in the case of the 'technical' curve are those of a perfectly competitive economy! Note that lowering the minimum real wage in terms of X_2 implies an upward shift of the horizontal part.

With L_2 constant and L_1 reduced in comparison to the previous situations, there is unemployment in the economy. The precise level for our graphical example is drawn as a parallel to the L_2-axis in part V of Figure 3. The less the terms of trade p_2/p_1 exceed the pre-trade price ratio, the lower is the level of

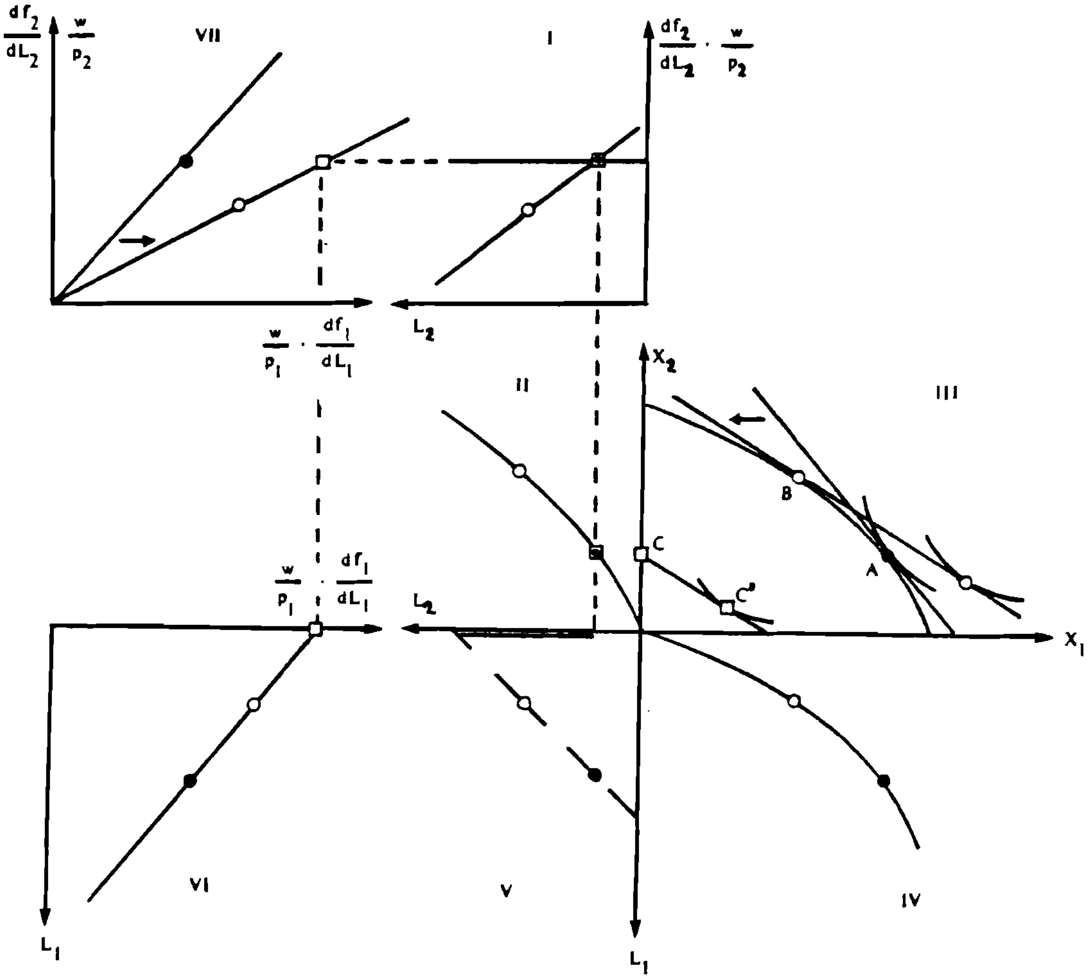
$\frac{df_2}{dL_2}$ $\frac{w}{p_2}$
VII
I
$\frac{df_2}{dL_2} \cdot \frac{w}{p_2}$
$\frac{w}{p_1} \cdot \frac{df_1}{dL_1}$
L_2
X_2
II
III
B
A
C
C'
$\frac{w}{p_1} \cdot \frac{df_1}{dL_1}$
L_2
X_1
VI
V
IV
L_1
L_1

FIGURE 3.

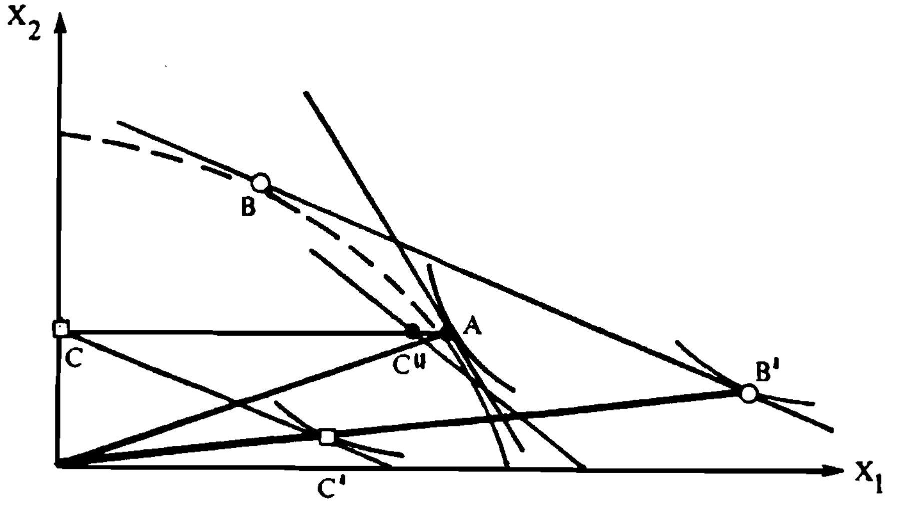

FIGURE 4.

unemployment.

Given the employment effects, labor income is reduced in terms of X_2 in comparison to both previous situations. In terms of X_1, it is clearly reduced compared to the free-trade, flexible-wage case; it can be raised or reduced in comparison to the pre-trade labor income as p_2/p_1 has been increased.

With no production, profits are of course zero in the first sector and are thus lower in terms of any commodity than in both cases treated before. Given the minimum real wage rate, this result holds for any level of the terms of trade below the pre-trade price ratio and is thus not confined to our special example of zero production in the first sector (see the explanations of how to find out graphically the profit income of a sector given in Section 3). Profits in the exporting sector remain constant in terms of X_2 but rise in terms of the import-competing commodity. However, the rise is smaller than in the flexible-wage case; thus profits in the exporting sector are smaller -- in terms of any commodity -- than in the flexible-wage case. Again these results hold for any price ratio exceeding that in the pre-trade situation. In summary, the overall sum of profits is reduced in terms of both commodities in comparison to the free-trade, general competitive equilibrium; in comparison to the pre-trade equilibrium, it is reduced in terms of X_2 whereas no general conclusion is possible in terms of X_1.

Summarizing profit and labor income effects, the national income effect is graphically indicated in terms of $X_1(X_2)$ by the horizontal (vertical) intercept of the budget line through points C and C' in part III of Figure 3 and in Figure 4. It is reduced in terms of X_2 in comparison to both previous situations for any international price ratio smaller than the pre-trade ratio. In terms of X_1, the same is true in comparison to the free-trade, flexible wage case; however no general conclusion is possible in comparison to the pre-trade case, as for the international price ratio exceeding that in our graphical example, the production point C is horizontally shifted (see C'' in Figure 4) so that the budget line might intersect the X_1-axis to the right of the pre-trade budget line.

In Figure 4, the solid line drawn from the origin to B' (A) represents effective household behavior in the commodity markets in view of alternative rationing levels on the labor market and thus for alternative income levels, given the price ratio associated with B' (A). For our graphical example, the negative effects on employment and income lead to reductions of demand for both commodities (spill-over effects) in comparison to both previous cases, as can be seen from the position of C'. Thus we clearly have a lower welfare level. Raising p_1/p_2 gradually back to the pre-trade level, the line indicating effective behavior $\overline{OC'B'}$ is gradually "shortened" and shifted towards the line $\overline{OA}$; the point of effective commodity demand C' moves towards A. Thus the results concerning commodity demand and welfare just mentioned hold for all price ratios smaller than the pre-trade ratio.

The preceding analysis can be summarized by the following statement. In comparison to the free-trade, general competitive equilibrium analysis, the opening of a small country for trade when the real wage rate in terms of the export-competing commodity must not fall below the pre-trade level, leads to:

- a stronger reduction in the output of the import-competing commodity. Production of the export-competing commodity remains unchanged, meaning that no specialization takes place;
- a stronger shift of the production structure in favor of the exportable commodity;
- a reduction of the employment level, which is directly connected to the decline of production of the import-competing commodity;
- a smaller labor income (in terms of any of the commodities);
- smaller profit incomes (in terms of any of the commodities) in both sectors;
- smaller demand quantities for both goods because of the income effects, which are in turn due to the employment reduction. In the terminology of the theory of temporary equilibrium with quantity rationing, the effects of the reduced employment level on the demand for commodities are called spill-over effects;
- a lower welfare level.

5.1.2. *Sectoral Rigidity*

In the case where the minimum real wage constraint is only valid for the second sector, employment L_1 and output X_1 are not determined: with L_2 remaining at its pre-trade level, L_1 can take any level between zero and the difference between total labor endowment $\bar{L}^S$ and L_2. The precise figure for L_1 will depend on the real wage rate the first sector has to pay. Corresponding to the two polar amounts for L_1, there are two polar values for this real wage:

(1) Production at the maximum level $X_1 = f_1(\bar{L}^S - L_2)$ takes place if the real wage rate in the first sector in terms of X_1 is prevented from rising. With real wage rates in both sectors constant in terms of the respective outputs, the change in the commodity price ratio in favor of X_2 implies a higher real wage rate in terms of any commodity in the second sector; this can be seen with the help of the free-trade price line in part VII of Figure 3. It should be clear that, for any absolute price level, this implies at the same time a differential between nominal sectoral wages. Apparently this case is connected with

completely different wage-setting behavior in both sectors: while it is orientated toward a given real wage rate in the second sector (possibly for reasons of maintaining purchasing power or the income shares of workers), it aims at providing full employment and/or high levels of output in the first. Thus, real wages in the first sector "suffer" from high claims in the second.

It should be noted that, with the real wage rate in the second sector perfectly flexible in the upward direction, no excess demand situation in the labor market can arise before the total labor supply has been taken over by the first sector. However, as production of the pre-trade quantities X_1 and X_2 already requires a wage differential, we neglect all combinations of X_1 and X_2 that are located to the right of point A on the transformation curve (for these require an even greater differential in favor of the wage rate in the second sector).

Figure 5 shows that opening the economy for trade leads only to one part of the possible welfare gain, i.e., the consumption gain (movement from A to Z). With both production quantities at their pre-trade levels, no specialization can take place; therefore the specialization or production gain (movement from Z to B') cannot be realized. For production and consumption gains see Johnson (1965, p. 14).

Profits in the first (second) sector in terms of X_1 remain constant (are raised), while they are reduced (remain constant) in terms of X_2. Total labor income in terms of $X_1(X_2)$ is raised (reduced).

(2) Zero production in the first sector requires that, after opening the economy for trade, the real wage in terms of X_1 is raised at least up to the amount of the marginal product at $L_1 = 0$. This might be justified by the hope of the first sector's labor force of obtaining a satisfactory part of the potential rise in national income. Given the independence of the sectoral wage claims underlying the present subsection, the real wage claim in the first sector will generally differ from that in the second sector.

The implications for production structure, employment level, profits, demand, and welfare are qualitatively the same as in Subsection 5.1.

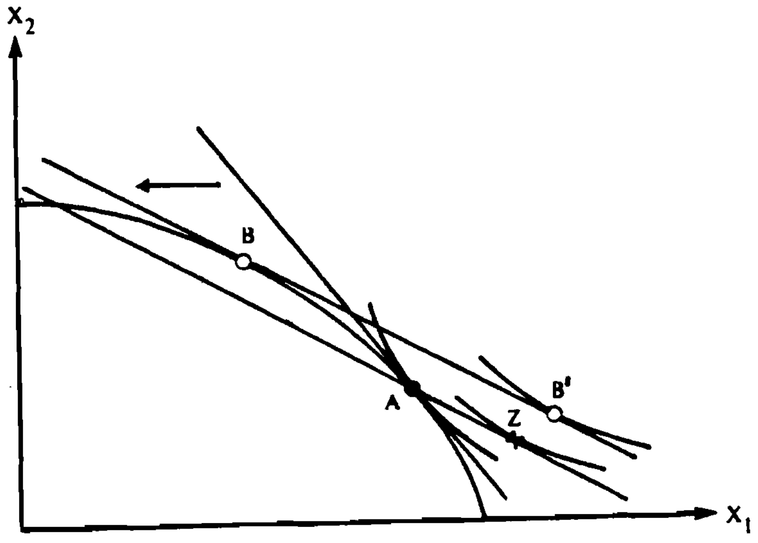

FIGURE 5.

5.2. More Downward Rigidities

As was shown in Section 3, the free-trade general-competitive equilibrium requires a rise in the real wage rate in terms of the import-competing commodity. Thus a downward rigidity in terms of X_1 does not impose any binding constraint on the economy.

Now suppose that the minimum real wage rate is given in terms of a constant utility combination of both commodities (see Figure 6). Graphically this means that the household wants to achieve at least the utility level represented by the indifference curve through point A. Given the international terms of trade, it therefore has to realize at least an income allowing for point S. By the following reasoning it can be shown that the implied wage restriction does not become binding: the position of the tangent to the indifference curve is determined by the "target income" of the household, i.e., by the income necessary to allow for the target utility level. On the other hand, the position of the tangent to the transformation curve is determined by the income implied by production point B. Assuming that the household correctly anticipates the profit income implied by point B, the positions of both tangents can only differ because of different labor incomes. Finally, with the full employment labor quantity underlying not only point B, but also point S (i.e., underlying not only the potential-production point, but also the minimum comsumption quantities), the tangent to the indifference curve must be connected with lower real wage rates in terms of both commodities than the tangent to the transformation curve.

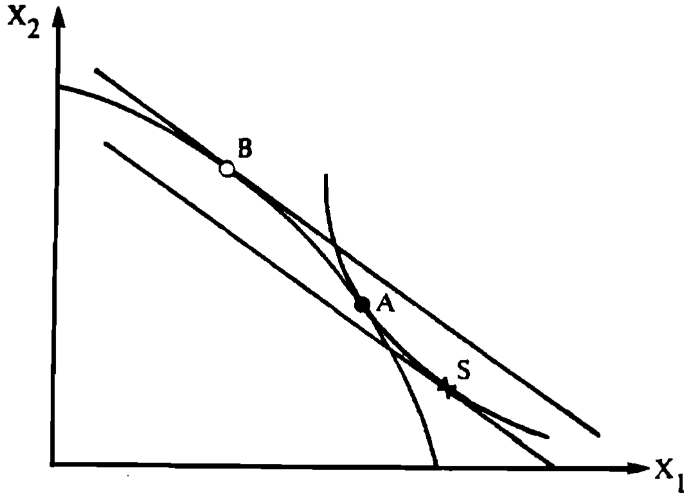

FIGURE 6.

It should be noted that our result -- namely, that the above wage restriction is not binding -- does not really require that the household expects full employment nor that it expects the sum of profits implied by point B. If it expects one or both of them to be smaller, it will raise its wage claims in order to preserve the income necessary for the consumption quantities of point S. As long as its expectations concerning profit income and employment do not underestimate by "too much" the profits and employment implied by production in point B, its wage claims will not be "too high", i.e., they will not prevent firms from producing in B and thus from realizing full employment.

6. COMPLETE RIGIDITY OF THE REAL WAGE RATE IN TERMS OF THE EXPORT-COMPETING COMMODITY

The step from downward to complete rigidity of wages can be interpreted as a step from the traditional treatment of factor price rigidity towards the so-called disequilibrium (or neokeynesian, fixed-price) theory. A pioneering contribution to this theory is that of Barro and Grossman (1971); the approach was introduced into the monetary macroeconomics of open economies by Dixit (1978), followed by Neary (1980). It is a rather short-run approach and views prices as sluggish in either direction; moreoever, as a simplification and in order to make the implications of sluggishness clearer, total price rigidity is assumed.

In the case of general complete rigidity, the resulting temporary equilibrium after the opening for trade is the same as in the case of downward rigidity: in the same way in which that equilibrium was connected in both sectors with the pre-trade levels of real wages in terms of X_2, it also constitutes the system's equilibrium position for the present case.

By a similar line of reasoning it can be shown that complete rigidity in only the second sector leads to the same problems and to the same range of possible temporary equilibria as in the case of downward rigidity.

7. COMPLETE RIGIDITY OF THE REAL WAGE RATE IN TERMS OF THE IMPORT-COMPETING COMMODITY

We analyze this case with the help of Figure 7, where the rigid wage in terms of X_1 is drawn as a vertical line in part VI.

7.1. General Rigidity

With the real wage rate in terms of X_1 rigid at the pre-trade level, the labor demand of the first sector is constant. On the other hand, the second sector's demand is raised: as can be seen from part VII, the wage rigidity, together with the trade-induced decrease in the commodity price ratio p_1/p_2 implies a lower real wage rate for the second sector and thus an incentive to raise output and employment. In sum, we have then excess demand in the labor market, marked by the vertical parallel to the L_1-axis in part V.

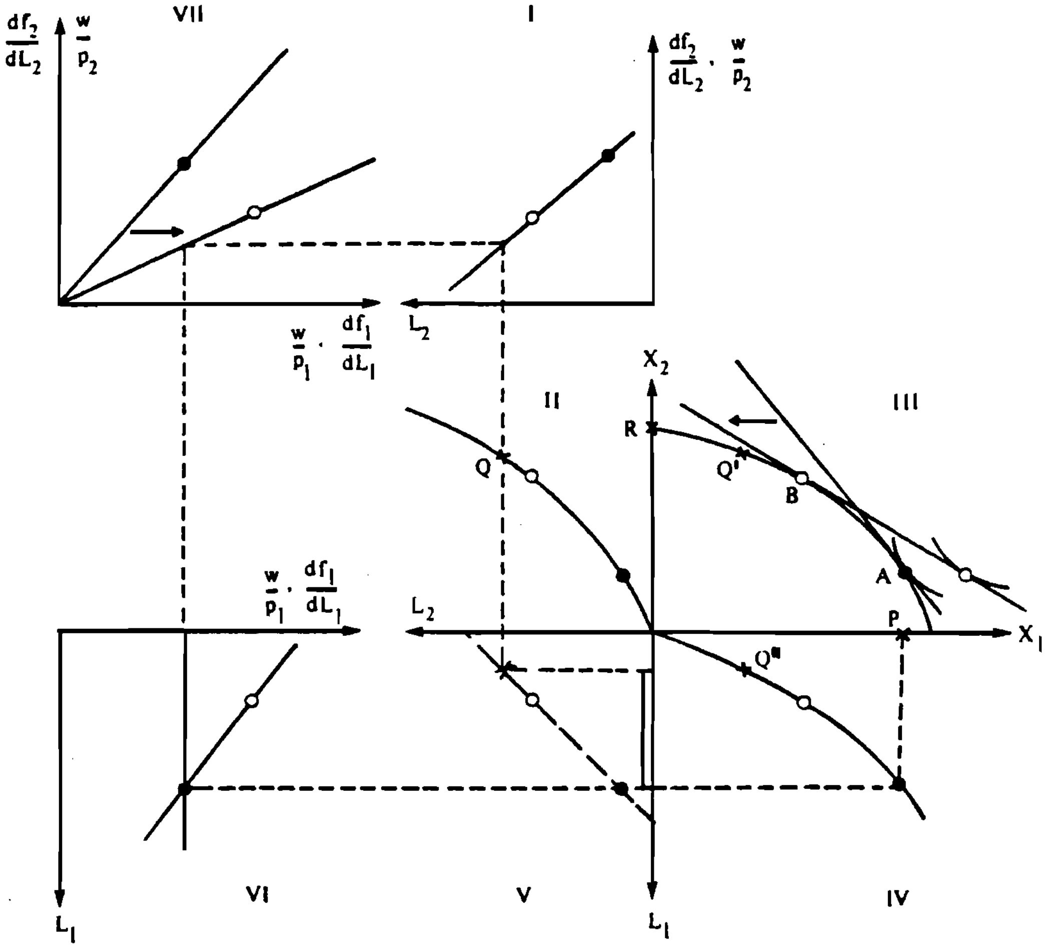
VII
I
$\frac{df_2}{dL_2}$ $\frac{w}{p_2}$
$\frac{df_2}{dL_2}$ · $\frac{w}{p_2}$
$\frac{w}{p_1}$ · $\frac{df_1}{dL_1}$
L_2
X_2
II
III
R
Q
Q'
B
A
$\frac{w}{p_1}$ · $\frac{df_1}{dL_1}$
L_2
P
X_1
Q''
L_1
VI
V
L_1
IV

FIGURE 7.

In this situation we cannot derive a temporary equilibrium position without introducing an explicit rationing scheme telling us how to divide total labor supply between the production sectors; on the relevance of rationing schemes for temporary equilibrium analysis see Meyer (1983, pp. 92-96, 111-115). The following rationing schemes could be considered in the present case:

(a) treatment of one sector as a priority purchaser, whose demand must be fully satisfied before the other sector gets any labor;

(b) maintenance of the pre-trade sectoral employment levels;

(c) uniform rationing, i.e., each sector gets the same amount of labor;

(d) proportional rationing, i.e., each sector gets the same percentage of its labor demand, with the percentage rates summing to one;

(e) optimal ("rational") rationing, i.e., both sectors are provided with the amounts of labor that lead to the maximum level of welfare for the present case.

In the following discussion, we will only consider schemes (a) and (e).

Treating the first sector as a priority purchaser implies that L_1 and X_1 are kept at their pre-trade levels. The remaining labor supply goes to the second sector, meaning of course that L_2 and X_2 are also kept at the original levels. As was discussed in Subsection 5.1.2, maintenance of the pre-trade production point A in part III means no specialization and structural change and thus allows only for the consumption, but not for the production gain. In contrast to Subsection 5.1.2, profits in the second sector are now raised in terms of X_2 because of the decline of the real wage rate in terms of X_2 (note that the rationing of the second sector implies that the marginal product of labor exceeds the real wage rate in that sector). Of course, they are raised even more in terms of X_1. Total labor income in terms of $X_1(X_2)$ is now kept constant (reduced).

Treating the second sector as a priority purchaser implies that L_2 and X_2 are chosen according to point Q in part II, leading to point Q' in part III. Thus, the second sector expands even more than in the flexible-wage case, leading to over-specialization. Given the change of p_1/p_2, a welfare loss in comparison to the pre-trade situation becomes more likely, the nearer point Q' is situated to the given point R (i.e., the less the marginal product of labor in the second sector is declining in that part of the production function that corresponds to the segment AR of the transformation curve). The same statement applies if we compare the welfare effect with that of the preceding rationing scheme. Profits in the first sector are reduced in terms of X_1 because at the unchanged value of the real wage rate the first sector can only produce at point Q'' rather than at the profit-maximizing pre-trade level in part IV (because of the rationing, the marginal product in the first sector exceeds the real wage rate). Of course profits go down even more in terms of X_2. Profits in the second sector go up in terms of both goods even more than in the flexible-wage case. Labor income is reduced in terms of both commodities in the first sector. It is raised in terms of X_1 in the second sector, while no precise statement can be made in terms of X_2. Thus, there are no clear-cut effects on aggregate labor income in terms of any commodity.

From part III of Figure 7 it can be seen that the welfare maximum can be achieved by a rationing scheme that provides each sector with the free-trade, flexible-wage amounts of labor (see point B and the corresponding points drawn as circles in the other parts of Figure 6). We might call this an "optimal" or "rational" scheme. In contrast to the cases just discussed, this implies rationing of both production sectors. However, there might be some resistance from different groups of people against this distribution of the country's labor endowment:

- in comparison to the case where the first sector is treated as a priority purchaser, profit and labor income in this sector are now lower in terms of any commodity;
- an analogous statement can be made for the second sector in comparison to the case where *it* is treated as a priority purchaser;
- in comparison to the pre-trade distribution, profit and labor income are reduced (raised) in terms of both commodities in the first (second) sector.

It can be concluded that there are substantial reasons for resistance to the optimal rationing scheme. Clearly, however, it can be shown by a similar line of reasoning that treating any of the sectors as priority purchaser always makes the other worse off in some sense in comparison to the pre-trade distribution. Thus, any priority classification will likewise be rejected by one sector. (Note that basing resistance to (or preference for) a specific rationing scheme on its consequences for sectoral labor incomes implies that there are at least two workers in the economy, one in each sector. This evidently contradicts our assumption of a single -- representative -- household. However, as this is a highly simplifying assumption, the discussion above of potential resistance to various rationing schemes is not entirely without interest.)

Furthermore, the above rationing schemes are all rather *ad hoc*. However, any rationing scheme will be made redundant in a longer than short-run period because wages will tend to rise and thus remove the excess demand for labor.

7.2. Sectoral Rigidity

As in the preceding subsection the profit-maximizing and thus the maximum level of X_1 is identical to the pre-trade level. However, with no restrictions on the real wage rate in the second sector, X_2 cannot be determined without further assumptions (it should be clear that in Figure 7 the dashed line drawn from part VII to part I and then downward, is no longer valid). Its range of possible levels is now bounded by zero and the complete-specialization quantity. Then the 'market transformation curve' is given by the segment between points R and A on the 'technical transformation curve' and the vertical line between points A and P. It is reproduced in Figure 8.

Assuming that even in the more short-run period underlying our analysis, labor supply reacts to sectoral wage differentials, the precise production point of the economy will entirely depend on the wage-setting behavior in the second sector:

- production to the left of point Q' can realistically be excluded because it requires a lower real wage rate (in terms of any commodity) in the second sector than in the first and at the same time implies rationing of the first sector. Thus, workers would move over into the first sector, removing its excess demand and reducing the second sector's employment and production levels until the real wage rate is raised at least to the level prevailing in the first sector;

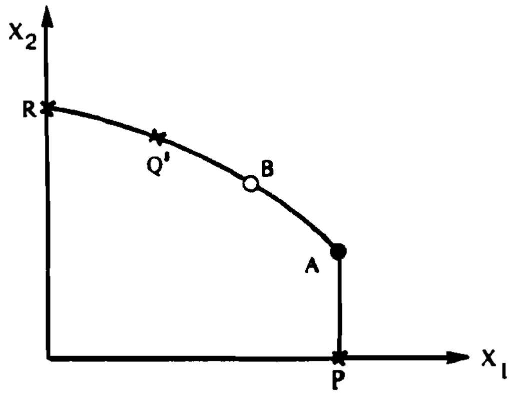

FIGURE 8.

- production between points Q' and A is still connected with rationing of the first sector, except for point A itself. Furthermore, it requires a higher real wage rate in the second sector than in the first;
- production will take place between points A and P if the real wage claims in the second sector are higher than before trade (see case (2) in Subsection 5.1.2 on this wage-setting behavior). All these points imply profit-maximizing outputs in both sectors, and all points except A imply unemployment, which becomes higher the more closely point P is approached.

In view of these reflections, only points on the segment Q'AP seem possible. The welfare effects of production between points Q' and A have been discussed in the preceding subsection. It is immediately clear that points on the segment AP imply less welfare than those between B and A.

8. SECTORAL DIFFERENTIAL BETWEEN WAGE RATES

The procedure of the preceding sections, where the wage restrictions only become binding after the opening for trade, is sometimes interpreted as the simultaneous introduction of trade and wage rigidities. Therefore it is criticized on the basis that the welfare effects due to the opening for trade cannot be clearly separated from those of the introduction of the rigidity; see Magee (1973, pp. 5-6) and the references cited therein. In this section it is assumed, on the contrary, that a differential between sectoral nominal wage rates has existed before trade is opened. This implies of course a corresponding differential between real wage rates (in terms of any commodity) for any given commodity price ratio. We assume here that this differential is given exogenously, in contrast to Subsections 5.1.2 and 7.2 where it was a (possible) result of confining real wage rigidity to one sector.

We assume the differential to be given in the following form, where w_i denotes the nominal wage rate to be paid by sector i:

$$w_1 = t \cdot w_2 \ , t > 1 \qquad (8.1)$$

As this differential exists before the opening for trade, we have an initial equilibrium different from that of the preceding sections, where it was given by point A in Figure 6. However, for the price ratio prevailing in A, the marginal rate of transformation dX_2/dX_1 (i.e., the slope of the transformation curve in the production point) must now be smaller than in point A, as can be seen from the following equations:

$$dX_1 = \frac{df_1}{dL_1} dL_1 = \frac{w_1}{p_1} dL_1$$

$$dX_1 = \frac{df_2}{dL_2} dL_2 = \frac{w_2}{p_2} dL_2$$

$$= \frac{w_2}{p_2}(-dL_1)$$

$$\frac{dX_2}{dX_1} = \frac{w_2/p_2}{w_1/p_1} = \frac{-w_2}{w_1} \cdot \frac{p_1}{p_2}$$

$$\frac{dX_2}{dX_1} = \frac{-1}{t} \cdot \frac{p_1}{p_2} \qquad (8.2)$$

In Figure 9 we assume point Z to exhibit this slope, so that this would be the production point at the pre-trade commodity price ratio of the preceding sections. Then, however, demand would be given by point T, so that we would have excess demand for (supply of) $X_1(X_2)$. Thus the pre-trade equilibrium is now characterized by a higher ratio p_1/p_2, for example by that indicated by the price line through point A'. In A' the marginal rate of substitution of both commodities in consumption is identical to the equilibrium price ratio, whereas the marginal rate of transformation in production is smaller. Therefore the indifference curve is not tangent to the transformation curve; because of this the factor $1/t$ in equation (8.2) is called the non-tangency factor; see Magee (1973, pp. 16-17).

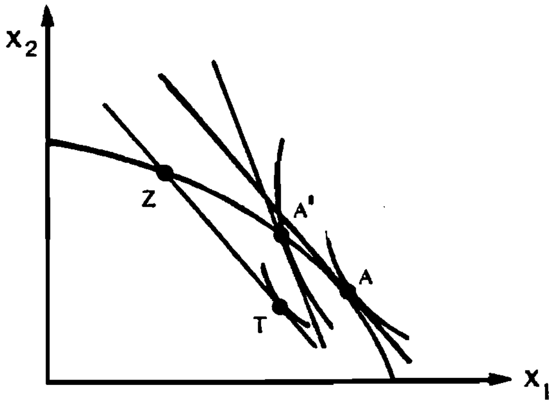

FIGURE 9.

We will analyze the effects of opening for trade with the help of Figure 10, which incorporates explicitly the nominal wage rates w_1,w_2 paid by the sectors in part VII. The slope of the price lines in that part is equal to $1/t$. Part VIII shows the value marginal product of labor in the second sector. Using X_1 as a numeraire ($p_1 = 1$), the corresponding schedule for the first sector is identical to the schedule of the marginal product in terms of X_1, as drawn in part VI.

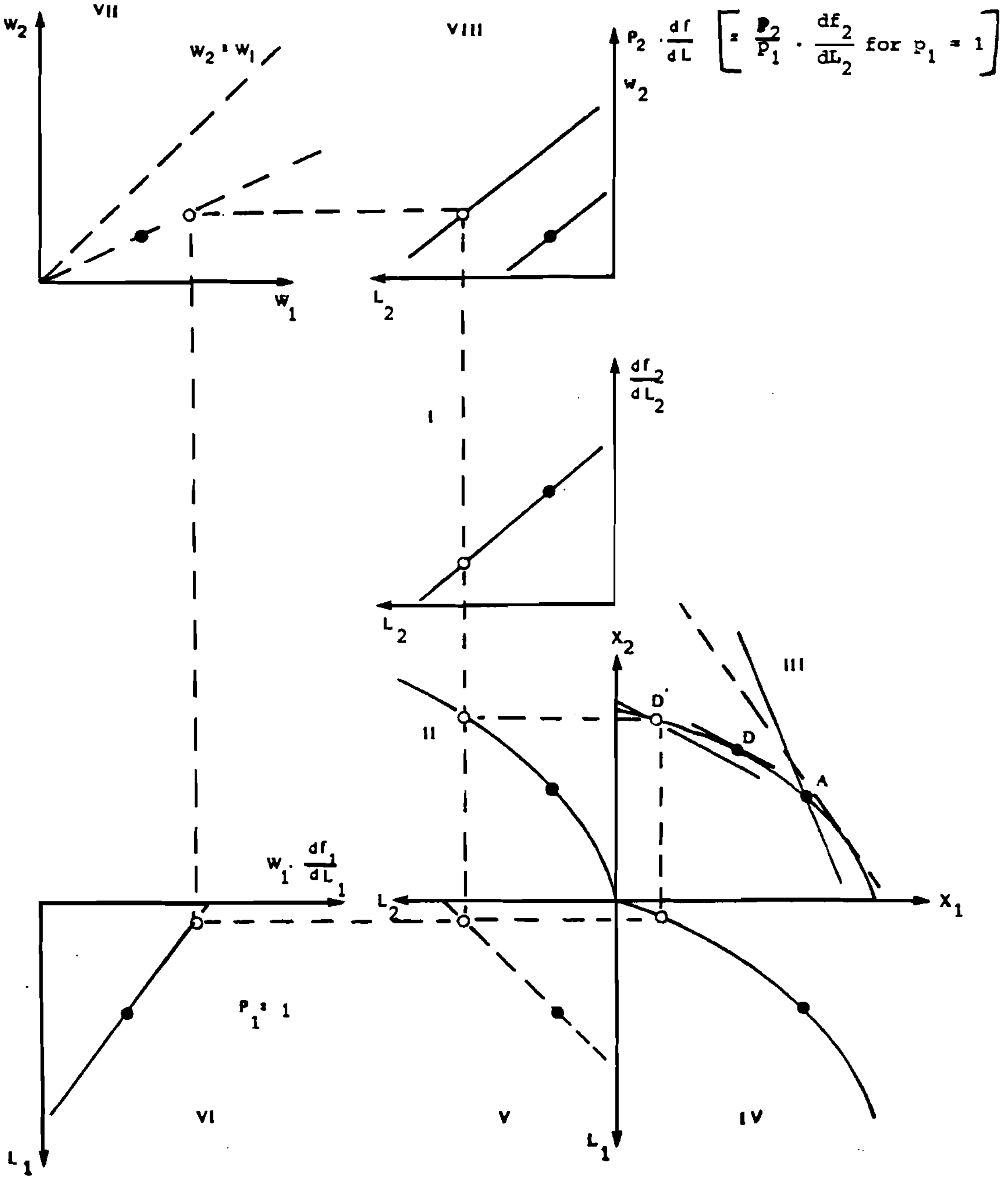
VII
w₂
w₂ = w₁
w₁
VIII
p₂ · df/dL [= p₂/p₁ · df₂/dL₂ for p₁ = 1]
w₂
L₂
df₂/dL₂
I
L₂
X₂
III
D'
D
A
II
w₁ · df₁/dL₁
L₂
X₁
p₁ = 1
VI
V
IV
L₁
L₁

FIGURE 10.

The pre-trade equilibrium is indicated by point A' in part III. The corresponding positions in the other parts of Figure 9 are marked as solid points.

The subsequent analysis of trade effects draws to some extent on the following work: Hagen (1958, pp. 504-506) treats the one-factor, fixed-input coefficient case; Magee (1973, pp. 11-13) reviews Hagen's article and gives an algebraic formulation. Johnson (1965, pp. 23-26), Chacholiades (1978, pp. 513-518), and Woodland (1982, pp. 499-503) discuss models with more than one factor of production.

As in the preceding sections we now assume that the domestic price ratio p_1/p_2 is smaller than the ratio on the world market, the latter (former) being indicated by the slope of the price line through point D' (A'). Moreover the international terms of trade are assumed to exceed the marginal rate of transformation in the pre-trade production point A'. Without any wage differential, production after trade would take place in point D. In view of the differential, the new equilibrium value for $w_1(w_2)$ must be higher (lower) than the value corresponding to D. Given the same terms of trade as in point D, this implies a higher (lower) real wage in the first (second) sector. Thus the new equilibrium point D' is characterized not just by an increased production of the commodity whose relative price was increased, but even by overspecialization in the sense that the marginal rate of transformation dX_2/dX_1 in the new production point is smaller than the international price ratio. A welfare gain may or may not be achieved (it should be noted that in a Ricardo-type model, i.e., for a model with fixed input coefficients, we will unambiguously have a welfare gain in this case).

Next let us suppose that the international terms of trade p_1/p_2 are smaller than the domestic ratio but greater than the marginal rate of transformation before trade. In part III of Figure 8 the ratio on the world market is indicated by the slope of the dashed price line. The point of tangency with the transformation curve would indicate the production point in the case of no differential. Since the differential exists, however, the production point lies to the left of A' as long as the foreign ratio does not exceed the domestic one; this result is also derived by Magee (1973, pp. 12-13) for the case of fixed input coefficients. In the present case the domestic country chooses a production point between points D and A'.

For a fixed-input coefficient model, Hagen (1958, pp. 504-505) shows that welfare is reduced in this case, implying that protection is superior to free trade. In our model, however, the fact that the world market ratio is smaller than the domestic ratio does not imply complete specialization in X_2 and thus does not lead to the sharp welfare reduction of Hagen's model. Therefore no clear-cut statement concerning the welfare change is possible in the present case.

Nevertheless our model resembles that of Hagen to a certain extent: because of the wage differential the domestic country does not specialize in X_1, as would be implied by the comparison of the international terms of trade p_1/p_2 with the marginal rate of transformation at the pre-trade production point A'. In this sense we may speak of an inverse specialization or a reversal of the patterns of trade. Because of this inverse specialization the country does not necessarily realize a welfare gain as would be the case in the absence of a differential.

Finally, suppose that the international terms of trade exceed the domestic ratio and are thus significantly greater than the marginal rate of transformation before trade. This implies specialization in X_1, i.e., in the right direction. However, the production point still lies to the left of the tangency point of the international price line and the transformation curve, implying again that the welfare maximizing production point is not realized. Nevertheless we can say with certainty that there is now a welfare gain.

It should be clear that the foregoing analysis can be carried out analogously when there is a differential in favor of the second sector's employees. In that case the national production point lies to the right of the tangency point of the price line and the transformation curve.

9. SUMMARY AND OUTLOOK

Using graphical expositions developed in Sections 2 and 3, Sections 5-8 of the present paper have analyzed the short-run effects of opening a small economy. The term 'short-run' was intended to denote a time horizon within which wage rates have not yet reached their (free-trade) general competitive equilibrium values (see Section 4 on this point). Therefore we do not interpret our discussion as contradictory to but rather as a complement to the long-run general competitive analysis. Depending on the adjustment process initiated by wage differentials or labor market imbalances, the results of the latter type of analysis may hold in the long run.

In Subsection 5.1.1 it was shown that general downward rigidity of the real wage rate in terms of the export-competing commodity prevents the home country from specialization and leads to unemployment and to production below the production possibility curve. Moreover, the production structure is raised in favor of the export-competing sector more than in the flexible wage case, while the level of welfare is reduced in comparison to the pre-trade situation.

Confining the rigidity to the export-competing sector, the temporary equilibrium position is not unique but depends on wage setting behavior in the importables sector (see Subsection 5.1.2). If this is orientated toward full employment, the pre-trade production quantities are preserved, meaning that only part of the possible welfare gain is realized. If instead it is aimed at a large part of the potential rise of national income, it will lead to unemployment and, probably, to a welfare loss.

In Section 6 it was argued that these results also hold in the case where the real wage in terms of the export-competing commodity is completely rigid.

Subsection 7.1 showed that a general complete rigidity of the real wage rate in terms of the import-competing commodity leads to excess demand in the labor market. Depending on the rationing scheme, the introduction of trade may have various effects on the sectoral production levels and thus on welfare. Treating the import-competing sector as a priority purchaser implies that the pre-trade production quantities are preserved and that only part of the possible welfare gain is realized. Treating the export-competing sector as a priority purchaser implies over-specialization in that sector's output; welfare may be increased or reduced, depending on the degree of the change in the terms of trade and on the production function of the second sector. We point out that there is an "optimal", i.e., welfare-maximizing rationing scheme characterized by the sectoral unemployment levels that would prevail in the flexible-wage case.

Confining the rigidity to the import-competing sector, temporary equilibria with excess demand as well as equilibria with excess supply in the labor market become possible, the latter probably implying lower welfare levels than the former. As in Subsection 5.1.2, the precise production quantities and thus the welfare level depend on wage-setting behavior in the sector in which there is no wage rigidity.

In Section 6, the labor market distortion (which is now a wage differential between sectors) already exists before trade. Depending on the difference between the domestic and the international price ratio, over-specialization or inverse specialization may occur (defined in a way appropriate for a country characterized by a wage differential). Only if the price ratio changes in favor of the sector paying the differential do we clearly have a welfare gain.

From the above results it can be concluded that, in view of non-instantaneous wage adjustment, the effects of trade will most probably differ from those of the traditional general competitive equilibrium. In the literature on optimal trade intervention in the two-factor model, however, it is shown for cases of general downward rigidity of the real wage rate and for factor price differentials that this does not imply that protection is the best policy measure but rather that policy intervention must take place at the exact point where the distortion occurs; see, e.g., Johnson (1965, pp. 5, 23-26), and Chacholiades (1978, pp. 501, 515-516, 524). Extending the scope of the present paper, this general rule for optimal trade intervention should be checked for our one-factor model. Furthermore, the time horizon of our model should be extended in order to illustrate the medium-run adjustment and the long-run response to the opening for trade. Several other extensions of our analysis seem possible, e.g., dropping the small-country assumption, disaggregating the household sector, etc. Most important, however, seem steps towards the integration of the long-run, pure theory of international trade and the more short-run, monetary macroeconomics of open economies; assuming sectoral capital inputs to be fixed and departing from the assumption of instantaneous adjustment of prices, the present paper can be viewed as an attempt to bring the former approach closer to the latter (at least if by the latter we mean Keynesian open-economy macroeconomics).

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