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Disequilibrium Trade Theories

Motoshige Itoh and
Takashi Negishi

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Motoshige Itoh

and

Takashi Negishi
University of Tokyo, Japan

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University of New South Wales, Australia

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Drawing on a personal network, an economist can still relatively easily stay well informed in the narrow field in which he works, but to keep up with the development of economics as a whole is a much more formidable challenge. Economists are confronted with difficulties associated with the rapid development of their discipline. There is a risk of "balkanisation" in economics, which may not be favorable to its development.

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The editors of the sections are outstanding economists who have selected as authors for the series some of the finest specialists in the world.

J. Lesourne *H. Sonnenschein*

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Disequilibrium Trade Theories

MOTOSHIGE ITOH and TAKASHI NEGISHI

University of Tokyo, Japan

INTRODUCTION

All happy families resemble one another, but each unhappy family is unhappy in its own way (Tolstoy). Equilibrium international trade theory belongs to a very homogeneous system of equilibrium economic theories developed by happy neo-classical economists who believe in the smooth functioning of the price mechanism in a free market society. Disequilibrium international trade theories are, however, quite heterogeneous, depending on related or corresponding different anti-neo-classical economic theories insisted on by unhappy economists who do not believe in the functioning of the price mechanism.

Among such anti-neo-classical theories, two theories are most important and most influential, i.e., neo-Ricardian or neo-Marxian theory ([41], [82]) and Keynesian theory. In the neo-Ricardian and neo-Marxian theories, real wages are given exogenously, i.e., by physiological, social and historical factors in neo-Ricardian and neo-Marxian theories, so that generally the labor market does not clear unless the Malthusian law of population works instantaneously. Keynesian economists assume that money wages are independent of the existence of the excess supply of labor: or, at least, they do not believe that the labor market is quickly cleared by changes in money wages. The disequilibrium trade theories to be surveyed below are, in a sense, related either to exogenously given real wages or to sticky money wages.

First, the problems of the so-called minimum wage economy are considered (in Sections one through three), where the labor market

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is subject to a wage floor which is exogenously given in real terms. The minimum real wage is considered to be set by some institutional arrangement such as custom, unions or law, and treated as a fact of life which, for social or political reasons, government and unions are unable or unwilling to alter ([3]). It will be shown that the introduction of the minimum real wage generates many interesting unorthodox results concerning unemployment, the terms of trade, gains from trade, international capital movements. We may emphasize, however, that these results are obtained by the use of theoretical tools developed in the neo-classical theory of international trade. The neo-classical economic theory can successfully be applied, with some necessary modifications, to the case of real wages exogenously given, whose importance has been insisted on by neo-Ricardian and neo-Marxian economists.

Keynesian economics with unchanged money wages and unemployment has recently been generalized to fix-price economics in which the prices of goods as well as wages are fixed in terms of money, independently of the existence of excess demand or supply in the goods and labor markets. The second problem we shall consider below is the application of the fix-price model to international trade (Sections four through seven). While some interesting results are available on unemployment, balance of payments, etc., our discussion will also reveal that important problems still remaining to be solved in this generalized Keynesian theory, i.e., in fix-price and quantity constraint models.

1. THE STRUCTURE OF MINIMUM-WAGE ECONOMIES

In this section we present simple models of minimum-wage economies and examine their production structure: we investigate how the patterns of production, consumption and trade are determined by commodity prices and the form of wage-rigidity. Although the way resources are allocated among industries depends on underlying production technology and the type of factor-price rigidity, minimum-wage economies, in general, share a common property that the slope of the transformation curve (marginal rate of transformation in production) is not equal to relative commodity price. This distortion, which is a result of the existence of unemployed factors of production, is the basic reason why minimum-wage economies have many special features that an undistorted economy does not have.

1.1. The basic model: specific-factors model with real wage rigidity

We first present a simple model, which will be used repeatedly in this paper to illustrate various results in their simplest forms. Consider the standard two-good model with three factors of production as follows:[1]

$$X_1 = F(L_1, K_1) \tag{1.1}$$

$$X_2 = G(L_2, K_2), \tag{1.2}$$

where K_1 and K_2 are, respectively, specific factors of production in sectors 1 and 2, which we call capital, and L_1 and L_2 are the amount of labor inputs in sector 1 and sector 2. Labor is assumed to be mobile between the two sectors. We assume that labor and the two types of capital are inelastically supplied. Denote by $\bar{L}$ the amount of labor supply. We then have

$$L_1 + L_2 = \bar{L}. \tag{1.3}$$

We call this model a specific-factors model.

Note that explicit consideration of capital is not necessary for the analysis in the present section and for the most part in the following sections. This particular formulation is adopted for convenience of dealing with the problem of industrial adjustment and that of capital movement, both of which will be discussed in the next section. One may assume production functions with labor the only explicitly considered factor of production and with decreasing marginal productivity of labor.

We assume that factor prices of the two types of capital are flexible while the factor price of labor, called the wage, is downward rigid. More specifically, we assume that the wage rate measured in units of good 2 has a minimum floor and the wage rate does not fall below the minimum floor level. This formulation of wage-rigidity is only for simple exposition. Other types of wage-rigidity will be introduced in Section 1.2.

[1] See Caves and Jones [33] for the structure of this model.

Several alternative reasons can be found for the downward rigidity of the real wage. The real wage may be indexed institutionally. The theory of the efficient wage, as expounded by Shapiro and Stiglitz [80], Weiss [89] and Yellen [91], provides a mechanism under which the real wage becomes downward rigid.

Figure 1 illustrates the allocation of labor between the two industries. On the vertical axis are plotted the values of the marginal product of labor in the two sectors measured in units of good 2, while on the horizontal axis are plotted the amounts of labor inputs in the two sectors, where the labor input in sector 1 is measured from the point 0_1 to the right and that in sector 2 is measured from the point 0_2 to the left. The curves A_1A_1 and A_2A_2 depict respectively the relation between the value of the marginal product of labor and the amount of labor input in sectors 1 and 2. The length of the line segment 0_10_2 represents the total labor supply of the economy, $\bar{L}$.

When the real wage rate in units of good 2 has a minimum-floor w_0, depicted on the vertical axis of the figure, L_1 units of labor will

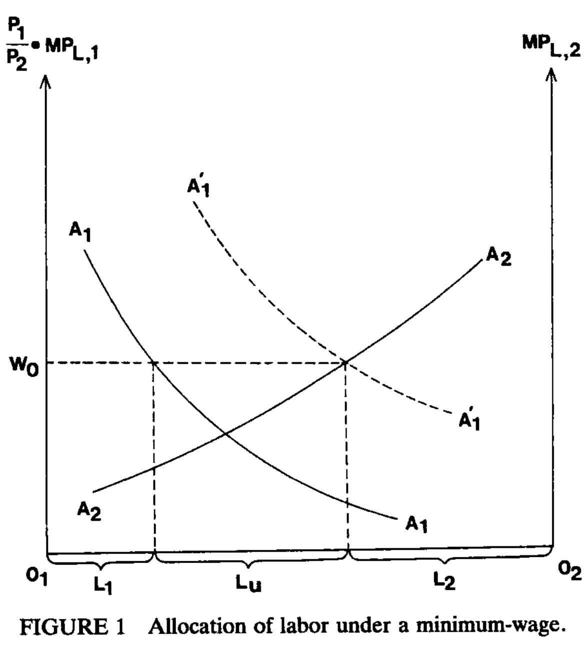

FIGURE 1 Allocation of labor under a minimum-wage.

be employed in sector 1, L_2 units of labor will be employed in sector 2, and L_u units of labor will become unemployed. (All of these are depicted on the horizontal axis of the figure.) Obviously, the amount of labor employed in each sector is determined by the level of the minimum-wage as well as by the relative price of the two goods. The higher is the minimum-wage level, the smaller is the amount of labor employed in each sector, and therefore the larger is the amount of unemployed labor. The amount of unemployed labor, under a given minimum-wage level, becomes smaller as the relative price of good 1 measured in units of good 2 becomes higher. A rise in the relative price of good 1 causes an upward shift of the curve A_1A_1 in Figure 1. The labor input in sector 1 increases while that in sector 2 does not change. Note also that when the relative price of good 1 is higher than the level indicated by the curve $A_1'A_1'$, the minimum-wage is no longer binding and labor will be fully employed.

The transformation curve of this economy has a shape like that of the curve *FEB* in Figure 2. The minimum-wage constraint is binding on the portion *EF*. As the relative price of good 1 rises, the production point moves to the right on the line segment *EF*, and

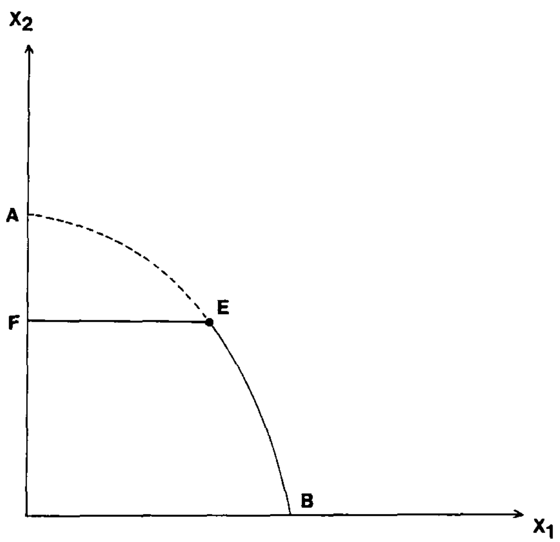

FIGURE 2 Transformation curve of a minimum-wage economy.

the employment and output of sector 1 increases while the output of sector 2 does not change. On the portion EB the real wage rate in units of good 2 is higher than the minimum-wage level, and therefore the minimum-wage constraint is not binding.

1.2. Some other forms of wage-rigidity

The simple model presented above can be used to consider other types of wage rigidity. In the present section we consider two types of wage rigidity which often appear in the trade literature: one is the case where wage restriction is specified by the so called wage function, and the other is the Harris–Todaro model.

Consider first the case where the minimum-wage level is given by the following wage function

$$w = H(p_1, p_2) \tag{1.4}$$

where w is a nominal wage rate, and p_1 and p_2 are the nominal prices of goods 1 and 2. Since our main concern in this section is real wage rigidity, we assume that there is no money illusion. The wage function then becomes linear homogeneous in p_1 and p_2 whose partial derivative with respect to each price is non-negative. Note that the wage-rigidity considered in the previous section is a special case of this wage function, where the partial derivative with respect to p_1 is zero.

When the wage function is linear homogeneous, the real wage rate in units of good 2, w/p_2 can be written as

$$w/p_2 = H(p_1/p_2, 1) \tag{1.5}$$

Therefore, the allocation of labor between the two sectors under the wage function is essentially the same as the one in the previous section with only minor modification: that is, w_0 in Figure 1 is replaced by $H(p_1/p_2, 1)$.

The amount of labor employed in each sector is determined as satisfying the following conditions as long as the minimum-wage constraint specified by the wage function is binding.

$$(p_1/p_2)MP_{L,1} = H(p_1/p_2, 1) \tag{1.6}$$

$$MP_{L,2} = H(p_1/p_2, 1) \tag{1.7}$$

where $MP_{L,1}$ $(i = 1, 2)$ is the physical marginal productivity of labor in sector i. By differentiating (1.6) and (1.7) logarithmically, we obtain

$$\hat{L}_1 = \{(1-\lambda)/\varepsilon_1\}(\hat{p}_1 - \hat{p}_2) \tag{1.8}$$

$$\hat{L}_2 = -(\lambda/\varepsilon_2)(\hat{p}_1 - \hat{p}_2) \tag{1.9}$$

where

$$\lambda = \frac{\partial H}{\partial p_1} \cdot \frac{p_1}{w}$$

$$\varepsilon_i = -\frac{dML_{L,i}}{dL_i}\frac{L_i}{MP_{L,i}} \qquad (i = 1, 2)$$

λ is the elasticity of $H(p_1/p_2, 1)$ with respect to the relative price p_1/p_2, which can be interpreted as the share of consumption expenditure on good 1, ε_1 and ε_2 are the elasticity of the marginal productivity of labor with respect to labor input in the two sectors, and the hat symbol "^" above each variable indicates the rate of change of the variable. (1.8) and (1.9) state that a rise in the relative price of good 1 increases the amount of labor employed in sector 1 and decreases that in sector 2.

The total amount of labor employed changes as satisfying

$$\hat{L} = \theta_1\hat{L}_1 + \theta_2\hat{L}_2 = \{(1-\lambda)\theta_1/\varepsilon_1 - \lambda\theta_2/\varepsilon_2\}(\hat{p}_1 - \hat{p}_2) \tag{1.10}$$

as long as the minimum-wage constraint is binding, where

$$\theta_1 = L_1/L, \qquad \theta_2 = L_2/L = 1 - \theta_1.$$

Therefore, the total amount of labor employed L and the relative price p_1/p_2 move in the same direction if and only if

$$(1-\lambda)\theta_1/\varepsilon_1 > \lambda\theta_2/\varepsilon_2.$$

We cannot make any general statement about the direction of the change in L, but if the elasticities ε_1, ε_2 and λ are constant, then there is a critical level $(p_1/p_2)^*$ of the relative price at which the amount of labor employed is the smallest, and the relative price p_1/p_2 and the amount of labor employed move in the same direction if and only if the relative price is higher than this critical level.

Although the relation between the amount of labor employed and the relative commodity price in the present case is different from the case previously considered, the two cases share two common properties that play an important role in the following sections: that is, the slope of the transformation curve, namely the marginal rate of transformation in production, is not generally equal to the relative commodity price, and the amount of labor employed changes with the relative commodity price.

Let us next explain the Harris–Todaro model briefly.[2] The economy consists of the rural sector (sector 1) and the urban sector (sector 2). The producer's wage in sector 2, namely the real wage rate in sector 2 measured in units of good 2, is downward rigid at some level, say w_0. The real wage in the rural sector is determined as satisfying the following condition:

$$w = (p_1/p_2)MP_{L,1} = w_0 L_2/(\bar{L} - L_1), \tag{1.11}$$

where w is the real wage rate in the rural sector measured in units of good 2.

The term $L_2/(\bar{L} - L_1)$ indicates the probability of being employed when a rural worker moves to the urban sector: $\bar{L} - L_1$ is the total labor supply to the urban sector, and L_2 is the amount of labor demand in the urban sector. Note that all workers not employed in the rural sector are assumed to move to the urban sector. The rural workers are paid their values of marginal product, while the workers employed in the urban sector are paid the amount $p_2 w_0$ in the nominal unit. It is assumed that the wage rate is higher in the urban sector than in the rural sector. Otherwise, labor is fully employed. For the workers in the rural sector there are two alternatives: one is to remain in the rural sector and earn the low wage, and the other is to move to the urban sector and look for a highly-paid job. The chance that the workers find jobs in the urban sector is given by the ratio of the total labor demand in the urban sector to the total labor supply in that sector. The expected real wage in the urban sector is the product of the probability of being employed and the wage rate w_0. Labor is then allocated between the two sectors so that the real wage rate in the rural sector is equal to the expected real wage rate in the urban sector.

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[2] See Bhagwati and Srinivasan [28] and Harris and Todaro [44] for the detail of this model.

Note that the essential structure of the Harris–Todaro model is the same as the simple model previously considered. Figure 3 illustrates the allocation of labor in this economy. w_0 is an exogenously given urban wage, and L_2 is the amount of labor employed in the sector. L_1 is the amount of labor employed in the rural sector, and the wage rate in the rural sector is equal to $\{L_2/(\bar{L} - L_1)\}w_0$. L_3 indicates the amount of unemployed labor.

1.3. More general characterization of minimum-wage economies

Although the analysis we have presented so far is enough for our discussion in the following sections, it might be useful to summarize the basic characters of minimum-wage economies in the framework of a many-good, many-factor model.

Consider an economy with n goods and $(m + m^*)$ factors of production. Each good is assumed to be produced under a production function

$$X_i = F^i(K_1^i, \ldots, K_m^i; L_1^i, \ldots, L_{m^*}^i), \qquad (i = 1, 2, \ldots, n),$$

where X_i is the output of good i, $K_1^i, \ldots, K_m^i; L_1^i, \ldots, L_{m^*}^i$ are the $(m + m^*)$ factors of production used for the production of good i,

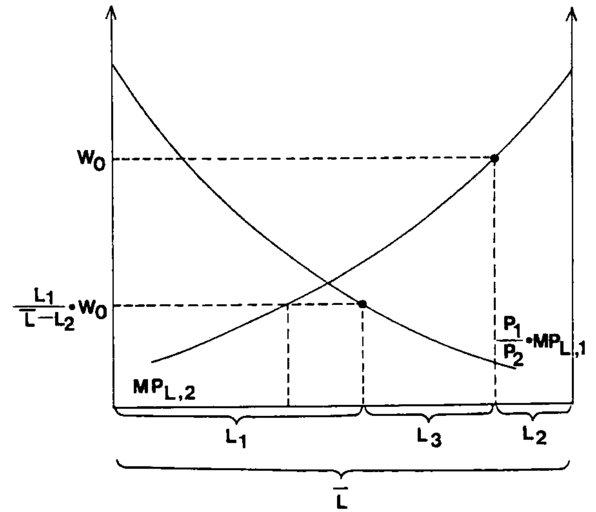

FIGURE 3 Allocation of labor in a Harris–Todaro economy.

and $F^i(\ldots;\ldots)$ is a neoclassical, linear homogeneous production function. Although we restrict our analysis to the case of non-joint production and no input of intermediate goods, extension of the analysis to more general cases is possible.[3]

m factors of production $K_1, \ldots, K_m$ are flexible-price factors of production, whose factor-prices move freely so as to satisfy full employment conditions for these factors. We denote by $r_1, \ldots, r_m$ these factor prices. m^* factors of production $L_1, \ldots, L_{m^*}$ are fix-price factors of production: their factor prices, denoted by $w_1, \ldots, w_{m^*}$, are downward rigid, and the levels of these minimum floors are so high relative to commodity prices (denoted by $p_1, \ldots, p_n$) that some portion of each factor is not used for production.

Note that the structure of the present model is essentially the same as a model with m^* factors internationally freely mobile under a given set of factor prices (small country assumption in the world factor market). In the former case some portion of each factor is not used for production, while in the latter case that part is used for the production in the rest of the world through international factor movements. Although the national income level is higher in the latter by the amount of factor rewards from the rest of the world, the domestic output level of each industry is exactly the same in the two cases.

Under the above setting, the relative size of n (the number of goods) and m (the number of flexible-price factors) become important to determine the nature of equilibrium just in the same manner as in the usual neoclassical trade models with many goods and many factors. When n is larger than m, the country does not produce all goods except in special cases. When n is smaller than m, the economy generally produces all goods unless prices of some goods are extremely high or low.

Consider first the case where n is larger than m. From the production function we can derive so called unit cost functions[4]

$$c^i(r_1, \ldots, r_m; w_1, \ldots, w_{m^*}) = \left\{\min \sum_{j=1}^{m} r_j K_j^i + \sum_{j=1}^{m^*} w_j L_j^i \text{: s.t. } F^i(K^i, L^i) \geqq 1\right\}$$

[3] See Neary [71].

[4] See Dixit and Norman [39] and Mussa [69] for the concept of the unit cost function.

where

$$K^i = (K_1^i, \ldots, K_m^i), \qquad L^i = (L_1^i, \ldots, L_{m^*}^i).$$

Using this unit cost function, factor market equilibrium under given commodity prices $p_1, \ldots, p_n$ and given fixed factor-prices $w_1, \ldots, w_{m^*}$ can be expressed by the following equations:

$$p_i \leqq c^i(r, w) \qquad i = 1, 2, \ldots, n,$$

where

$$r = (r_1, \ldots, r_m), \qquad w = (w_1, \ldots, w_{m^*}).$$

Good i is produced only when the above condition is satisfied with equality for good i.

It is obvious that the economy will specialize in the production of at most m goods except under special set of prices. Figure 4 illustrates the above point in the case of two goods, one flexible-price factor (called capital) and one fix-price factor (called labor). This case is discussed by Brecher [2, 3].

The curves 11 and 22 denote respectively the values of r and w satisfying:

$$p_1 = c^1(r, w)$$

$$p_2 = c^2(r, w),$$

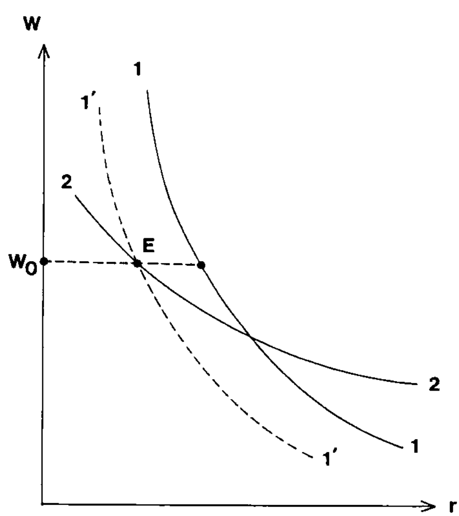

FIGURE 4 Factor-price frontiers and a minimum-wage.