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長期契約、理性預期及固定滙率下的貿易餘額動態變化

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摘　要

雖然有關理性預期下長期勞動契約對總體經濟影響的文獻很豐富，但是對長期貿易契約則未涉及。本文將長期貿易契約同時與勞動契約導入固定匯率下的理性預期總體經濟模式，使各期的所得與相對價格對貿易的影響及各期勞動契約的續約率動態化，進而能做全期分析，即除一般的長短期外還包括中期分析。當無法預期的幣值貶值發生時，本模式可產生各種不同的貿易調整動態變化，在貶值後的最初期，若預期相對價格效果愈小則J曲線效果時間愈長。在短期內，若J曲線效果大於實質利率效果，則貶值當期的總產出會萎縮。

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LONG-TERM CONTRACTS, RATIONAL EXPECTATIONS AND TARDE BALANCE DYNAMICS UNDER FIXED EXCHANGE RATES

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Abstract

In this paper, a rational expectations model incorporating long-term trade contracts and labor contracts is developed. It allows the relative price and income effects on the trade balance and the renewal rates of labor contracts to change over time, thus making possible an intermediate-run analysis as well as short-run and long-run analysis. The model generates a rich variety of gradual and nonmonotonic adjustment paths for the trade balance after an unanticipated devaluation under fixed exchange rates. It also shows that the low expected relative price effect in the initial periods can prolong the duration of J-curve effects which are created by the unanticipated devaluation. If J-curve effects dominate the real interest rate effect in the short run, the devalution has a contemporaneousely contractionary effect on output.

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LONG-TERM CONTRACTS, RATIONAL EXPECTATIONS AND TRADE BALANCE DYNAMICS UNDER FIXED EXCHANGE RATES

1. Introduction

Recently, the existence of a phenomenon which has been called the J-curve effect after currency devaluations has been recognized and incorporated into the theory of the trade balance. The term J-curve refers to an immediate decline and subsequent improvement in the trade balance following a devaluation. The J-curve result ensues if the proportion of trade contracts denominated in foreign currency is higher for imports than for exports.

The simplest model of a J-curve effect, devised by Williamson (1972), involves a one-period lag in the effect of the nominal exchange rate on trade volumes and an unlagged effect of the nomianl exchange rate on the import price. He wrote the trade balance equation as

$$T_t = - a_3 e_t + \bar{a}_4 e_{t-1} \tag{1}$$

where T_t is the domestic trade balance (not in log); e_t denotes the logarithm of the value of the foreign currency in terms of the domestic currency; and $\bar{a}_4$ exceeds a_3 by viratue of the Marshall-Lerner condition.[1]

Driskill and McCcafferty(1980) incorporated rational expectations in equation (1) by replacing e_{t-1} with ${}_{t-1}e_t$, the nominal exchange rate of time t expected at time t-1. In both equation (1) and the modified version of Driskill and McCafferty, the nominal exchange rate effect on the trade balance remains constant after the first period. Furthermore, the nominal instead of the real exchange rate or relative price affects trade flows.[2] In a subsequent paper. Driskill(1981) emphasizes the real exchange rate by replacing (1) with

$$T_t = - a_3(e_t - p_t) + \bar{a}_4({}_{t-1}e_t - {}_{t-1}p_t) \tag{2}$$

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where p_t is the logarithm of the domestic price level, and the foreign price level is normalized to one. But equation (2) retains a flaw, namely that all international traders are assumed to have trade contracts with a one-period delivery lag. Consequently, the relative price elasticity of the trade balance is constant over time, and the model incorporating equation (2) can generate only a simple, instantaneous and monotonic adjustment process for the trade balance in the intermediate run.

But, in reality, the process is not so simple. For instance, the devaluations of the Korean won in Dcecber 1974, the British pound sterling in November 1967 and the Nepalese rupee in october 1975 brought about complex, gradual and nonmonotonic time paths for their trade balances.[3] In order to explain this phenomenon, we have to devise a more sophisticated trade balance equation, one that recognizes that different traders have trade contracts with varying delivery lags. For instance, the delivery lags for US imports from Japan in 1973 were 43 days for calculators, 89 days for auto parts, 52 days for motorcycles and and 176 days for steel.[4] Hence, different traders may form their expectations about current relative price and real income with different lead times.

Suppose we divide international traders into several groups according to their delivery lags. In each period, each group accounts for some part of the total volume of trade. The trade balance equation incorporating the overlapping trade contracts becomes

$$T_t = - a_3(e_t - p_t) + \sum_{i=1}^{N} a_{3+i}({}_{t-i}e_t - {}_{t-i}p_t) - \sum_{i=1}^{N} a_{3+N+i}\ {}_{t-i}y_t \qquad (3)$$

where y is output level (not in log) and N is the total number of groups with different delivery lags, and a_{3+i} and a_{3+N+i} are the expected real exchange rate and income effects on the trade balance respectively for the trader group with a delivery lag of i periods.

This paper constructs a rational expectations model with long-term

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trade and labor cotracts that generates gradual and nonmonotonic adjustment paths for the trade balance after an unanticipated devaluation. For instance, after an initial decline for one or two periods, the trade balance might improve gradually and continuously for the next two or three periods, then decines for the last two or three periods to approach the initial level. A significant feature of the model is its abillity to analyze the intermediate run.

In the next section, the model is set up. Section 3 presents the solutions of the model. Section 4 compares the solutions with those of three special cases without long-term trade contracts. Conclusions are contained in section 5.

2.The Model

In our model, a small open economy faces a given world interest rate and a perfectly elastic supply of imports at prices given in terms of a foreign currency. The trade balance equation incorporates overlapping trade contracts in goods markets. Domestic and foreign bonds are assumed to be perfect substitutes and capital is perfectly mobile in asset markets. On the supply side, a simple price equation, relating prices to expected wages and output, and overlapping six-period wage contracts are used to reflect short-run price and wage rigidity.

2.1. The Goods Markets

A key difference between our model and those in the recent literature, such as Driskill (1981) and Ueda (1983), is the assumption that different agents form expectations with different lead times rather than just one period ahead. The difference arises from the assumed length of the delivery lag for trade contracts. In the recent literature, all trade contracts are assumed to have a one-period delivery lag, but our model considers trade contracts with various delivery lags.

The concept of trade contracts, mentioned in the introductory section, is one of the main points in this paper and warrants a more detailed expla-

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nation. In Driskill (1981), J-curve effects stem from equation (2). That is, the trade balance at time t is assumed to be a linear function of the log of the relative price at time t and of the conditional expectation taken at time t-1 of the log of the relative price at time t. The assumption that the current trade balance depends on prior expectations of current relative prices captures the idea that there are lags in the production process and consumption decision regarding exports and imports. But equation (2) has two shortcomings. The first is the absence of a clear distinction between the short-run and long-run reactions to changes in relative prices. For instance, $\bar{a}_4$ is assumed constant over time. The Marshall-Learner condition is assumed to hold, which implies $\bar{a}_4 > a_3$. But the reactions of imports and exports to changes in relative prices tend to be small in the short run and large in the long run, suggesting that the condition is more likely to hold in the long run than in the short run.

The second shortcoming, already mentioned in the introductory section, is that all trade contracts are assumed to have the same delivery lag and all traders to form their expectations about current relative prices and income in the previous period. In reality, however, different agents form their expectations with different lead times. Some may form their expectations two periods earlier, others three periods earlier, and so on. The lead time depends on the length of their trade contracts, or what Magee(1973) called the currency-contract period. According to Magee(1973), the trade-contract period is the period immediately following a devaluation in which contracts negotiated prior to the change fall due. For importers, the length of the period between the ordering of foreign merchandise and its delivery at the port of entry can be divided into three lags: the production lag, the transportation lag and the entry lag. The production lag is the period between acceptance of an order and export. The transportation lag is the period between the date of exportation and the date of importation. Finally, the entry lag is the lag between the date of importation and the date of entry.[6]

Using an invoice sample of US imports from Japan and West Germany

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for 1971 and 1973, Magee(1974) calculated the three lags in the trade-contract period by product for Japan and West Germany. The total trade-contract period for US imports from Japan tended to be short for calculators, car parts and motorcycles. The longest was for steel. In case of West Germany, the longest lag was for machine tools.

Magee(1974, pp.132-133) show that traders of different industries have different delivery lags. It is natural that different traders would form their rational expectations with different lead times. For in stance, the delivery lag for German machine tools was 259 days on average and the trade contracts were denominated in marks. United States importers of machine tools had to form their expectations about the dollar/mark exchange rate and their income at least 259 days ahead. Similarly, because the average delivery lag for Japanese calculators was 74 days, US importers of calculators had to form their expectations for the next 74 days about the dollar/yen exchange rate and their income. If they expected the dollar to devalue or their income to decrease within the delivery lag of their imports, they may have decreased the size of their orders or canceled them. The resulting decrease in imports improved the US trade balance. That implies that the coefficients a_4 through a_9 are positive but a_{10} through a_{15} are negative.

Magee(1974, pp.132-133) was calculated from the data taken from a one percent sample of the US customs invocies for imports from Japan and West Germany in the fiscal years 1971 and 1973. Therefore, the results from Magge(1974, pp.132-133) needs not hold for all imports or for different periods. One should not be surprised by longer or shorter delivery lag than those in Magee(1974, pp.132-133) if another sample were used instead. Having discussed the concept of trade contracts, we apply it to the aggregate demand function. The aggregate demand for domestic goods is the sum of the spending on domestic goods by domestic and foreign residents. Alternatively, it can be written as the sum of aggregate spending by domestic residents and the trade balance.

Aggregate spending by domestic residents depends negatively on th real interest rate and positively on real income because expenditure by investors is a decreasing function of the real interest rate and spending by consumers in an increasing function of real income. Hence, aggregate spending by domestic residents is given by the equation

$$a_0 - a_1(i_t - {}_tp_{t+1} + p_t) + a_2y_t$$

where a_1 and a_2 are positive constants, and i_t is the domestic nominal interest rate at time t.

For the trade balance, we use equation (3) incorporating the concept of trade contracts, and set N arbitrarily equal to six. Hence, the trade balance, measured in terms of the domestic currency, is given by the equation

$$T_t = - a_3(e_t - p_t) + \sum_{i=1}^{6} {}_{3+i}({}_{t-i}e_t - {}_{t-i}p_t) - \sum_{i=1}^{6} a_{9+i}\,{}_{t-i}y_t \qquad (4)$$

The log of the foreign price level is suppressed because it is assumed to equal zero by normalization. The term $e_t - p_t$ measures the contemporaneous relative price of domestic goods so that $a_3(e_t - p_t)$ reflects contemporaneous J-curve effects on the trade balance. The term ${}_{t-i}e_t - {}_{t-i}p_t$ measures the anticipated relative price of domestic goods expected at time t-i. Although setting N equal to six is arbitrary, six periods are long enough to allow the trade balance to adjust gradually and nonmonotonically, which permits us to do an intermediate-run analysis.

The valuses of the coefficients a_i depend on how early the agents form their expectations and the relationship between imports and exports and expectations. Generally, a_4 and a_5 may be greater than a_7 and a_8, and a_{10} may exceed a_{15}. In addition, we assume in equation (4) that all contracts for international transactions are written in terms of producers' currencies.[6] Therefore, the trade balance is affected by a currency devaluation only through the valuation of imports.[7] Hence. the goods market equilibrium condition is given by the equation

$$y_t = a_0 - a_1(i_t - {}_tp_{t+1} + p_t) + a_2y_t - a_3(e_t - p_t)$$

$$+ \sum_{i=1}^{6} a_{3+i}({}_{t-i}e_t - {}_{t-i}p_t) - \sum_{i=1}^{6} a_{9+i}\ {}_{t-i}y_t \tag{5}$$

2.2 The Assets Markets

Since real money demand depends positively on real income and negatively on the rate of interest, the demand for money is assumed to have the form

$$(m_t)^d - p_t = b_0 + b_1y_t - b_2i_t \tag{6}$$

where m_t is the log of the money supply, and b_1 and b_2 are positive constants. Domestic asset holders are assumed to demand domestic money, and domestic and foreign bonds. The money supply is fully endogenous under fixed exchange rates. Monetary equilibrium is described in equation (7) by the equality of the real money stock $m_t - p_t$ and the demand for real money balances:

$$m_t - p_t = b_0 + b_1y_t - b_2i_t \tag{7}$$

Domestic and foreign bonds are assumed to be perfect substitutes given a proper premium to offset anticipated exchange rate changes. If the domestic currency is expected to depreciate, domestic interest rates will exceed those abroad by the expected rate of depreciation. That relationship is expressed in equation (8)

$$i_t = i^* + {}_te_{t+1} - e_t \tag{8}$$

where i* is the given world interest rate. Equation (8) represents perfect capital mobility and it is assumed that incipient capital flows will ensure

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that equation (8) holds at all times. Furthermore, equation(8) implies that the domestic nominal interest rate is tied to the world interest rate through expected exchange rate changes. The domestic interest rate is lower than the world interest rate when an appreciation is anticipated and higher when a devaluation is expected. Under fixed exchange rates, as long as the current exchange rate is ecpected to continue, i.e., ${}_te_{t+1} = e_t$, the domestic interest rate equals the foreign interest rate. As our objective is to emphasize the role of expectations in a devaluation, however, the interest rate parity condition is appropriately described by equation (9) even though in any given period e_t may not change.

Under fixed exchange rates, the exchange rate is exogenous. Assume the authorities set the exchange rate on the basis of disturbances which have occurred up to and including period t:

$$e_t = \sum_{i=0}^{\infty} v_{t-i} \tag{9}$$

where the random terms v's are white noise processes with variances σ_v^2; the v's are permanent disturbances. Equation (9) could be made more general by allowing the coefficients of the random shocks to differ. This would permit us to analyze the J-curve phenomenon in a more general environment, but it would not alter any of the essential conclusions of this paper.

2.3. Price and Wage Equations

In order to reflect short-run price rigidity, the supply side of the economy is represtented by a simple price equation in which current prices relate positively to anticipated wages and the GNP gap. The equation for this is

$$p_t = {}_{t-1}w_t - d({}_{t-1}y_t - \bar{y}) \tag{10}$$

where w is the log of the level of the nominal wage, $\bar{y}$ is potential output and d is an adjustment coefficient. In equation (10), p_t is predetermined

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because ${}_{t-1}y_t$ and ${}_{t-1}w_t$ are anticipated. Anticipated output, ${}_{t-1}y_t$, is demand determined by equation (5). When the aggregate demand for domestic goods is anticipated to increase, anticipated output increases and the price level increases too. Since the left-hand side of equation (10) is based on information available at time t-1, the contemporaneous P_t is unchanged when a devaluation occurs at time t. That is, P_t does not respond to any information available in period t because of the price rigidity. Ueda(1983) makes the same assumption. Further, the assumption can incorporate the main idea behind Dornbusch(1976) that goods markets adjust relatively slowly.

In equation (10), ${}_{t-1}w_t$ relates to the wage setting, or labor contracts of Fischer(1977). If firms renew labor contracts every six periods, and if the goal of nominal wage setting is to maintain constancy of the real wage, then

$$ {}_{t-i}w_t = z + {}_{t-i}p_t, \quad i - 1,......,6. \tag{11} $$

where ${}_{t-i}w_t$ is the log of the wage set at the end of period t-i for period t and z is a scale factor in the determination of the real wage and will be set at zero for convenience.

Suppose the labor contracts drawn up at the end of period t specify nominal wages for periods from t+1 to t+6. In period t, c_i percent of the agents operate in the ith year of a labor contract drawn up at end of t-i. The average wage for the economy as a whole at t is

$$ w_t = \sum_{i=1}^{6} c_i \; {}_{t-i}p_t, \quad \sum_{i=1}^{6} c_i = 1, \; c_i > 0 \tag{12} $$

The purpose of choosing six periods for labor contracts is to match setting N to six for trade contracts.[8]

To summarize, the following set of equations describes the economy:

$$ y_t = a_0 - a_1(i_t - {}_tp_{t+1} + p_t) + a_2y_t - a_3(e_t - p_t) $$

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$$+\sum_{i=1}^{6} a_{3+i}({}_{t-i}e_t - {}_{t-i}p_t) - \sum_{i=1}^{6} a_{9+i}\ {}_{t-i}y_t \qquad (5)$$

$$m_t - p_t = b_0 + b_1 y_t - b_2 i_t \qquad (7)$$

$$i_t = i^* + {}_t e_{t+1} - e_t \qquad (8)$$

$$e_t = \sum_{i=0}^{\infty} v_{t-i} \qquad (9)$$

$$p_t = {}_{t-1}w_t + d({}_{t-1}y_t - \bar{y}) \qquad (10)$$

$$w_t = \sum_{i=1}^{6} c_i\ {}_{t-i}p_t, \quad \sum_{i=1}^{6} c_i = 1, \ c_i > 0 \qquad (12)$$

3. The solution of the Model

Using Muth's (1961) method of undetermined coefficients in the time domain using moving averages, we solve the model. The solutions for the time paths of output, the price level, the money supply, the wage rate, the interest rate and the trade balance are

$$y_t = y_0 + \alpha_1 v_t + \alpha_2 v_{t-1} + \alpha_3 v_{t-2} + \alpha_4 v_{t-3}$$

$$+ \alpha_5 v_{t-4} + \alpha_6 v_{t-5} \qquad (13)$$

$$p_t = p_0 + \beta_2 v_{t-1} + \beta_3 v_{t-2} + \beta_4 v_{t-3}$$

$$+ \beta_5 v_{t-4} + \beta_6 v_{t-5} + \sum_{i=1}^{\infty} v_{t-i} \qquad (14)$$

$$m_t = m_0 + \gamma_1 v_t + \gamma_2 v_{t-1} + \gamma_3 v_{t-2} + \gamma_4 v_{t-3}$$

$$+ \gamma_5 v_{t-4} + \gamma_6 v_{t-5} + \sum_{i=1}^{\infty} v_{t-i} \qquad (15)$$

$$w_t = p_0 + k_2 v_{t-1} + k_3 v_{t-2} + k_4 v_{t-3}$$

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$$+ k_5 v_{t-4} + k_6 v_{t-5} + \sum_{i=1}^{\infty} v_{t-i} \tag{16}$$

$$i_t = i^* \tag{17}$$

$$\begin{aligned} T_t = T_0 - g_1 v_t + g_2 v_{t-1} + g_3 v_{t-2} + g_4 v_{t-3} \\ + g_5 v_{t-4} + g_6 v_{t-5} \end{aligned} \tag{18}$$

where

$$\beta_1 = 0$$

$$\beta_2 = \frac{a_4 - a_3}{\frac{1}{d}(1 - a_2 + a_{10})A_2 + (a_4 - a_3)}$$ [9]

$$\beta_3 = \frac{a_5 + a_4 - a_3}{\frac{1}{d}(1 - a_2 + a_{10} + a_{11})A_3 + (a_5 + a_4 - a_3)}$$

$$\beta_4 = \frac{a_6 + a_5 + a_4 - a_3}{\frac{1}{d}(1 - a_2 + a_{10} + a_{11} + a_{12})A_4 + (a_6 + a_5 + a_4 - a_3)}$$

$$\beta_5 = \frac{a_7 + a_6 + a_5 + a_4 - a_3}{\frac{1}{d}(1 - a_2 + a_{10} + a_{11} + a_{12} + a_{13})A_5 + (a_7 + a_6 + a_5 + a_4 - a_3)}$$

$$\beta_6 = \frac{a_8 + a_7 + a_6 + a_5 + a_4 - a_3}{\frac{1}{d}(1 - a_2 + a_{10} + a_{11} + a_{12} + a_{13} + a_{14})A_6 + (a_8 + a_7 + a_6 + a_5 + a_4 - a_3)}$$

$$\beta_7 = \beta_8 = \cdots = 1$$

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where
$$A_2 = c_6 + c_5 + c_4 + c_3 + c_2$$

$$A_3 = c_6 + c_5 + c_4 + c_3$$

$$A_4 = c_6 + c_5 + c_4$$

$$A_5 = c_6 + c_5$$

$$A_6 = c_6$$

$$\beta_8 = \beta_7 > \beta_6 > \beta_5 > \beta_4 > \beta_3 > \beta_2, \quad \beta_1 = 0;$$

$$\alpha_1 = \frac{a_1 \beta_2 - a_3}{1 - a_2} \gtrless 0$$

$$\alpha_2 = \frac{1}{d} A_2 B_2, \quad \alpha_3 = \frac{1}{d} A_3 B_3, \quad \alpha_4 = \frac{1}{d} A_4 B_4,$$

$$\alpha_5 = \frac{1}{d} A_5 B_5, \quad \alpha_6 = \frac{1}{d} A_6 B_6, \quad \alpha_7 = \alpha_8 = \cdots = 0;$$

$$\gamma_1 = b_1 \alpha_1, \quad \gamma_2 = \beta_2 + b_1 \alpha_2, \quad \gamma_3 = \beta_3 + b_1 \alpha_3,$$

$$\gamma_4 = \beta_4 + b_1 \alpha_4, \quad \gamma_5 = \beta_5 + b_1 \alpha_5, \quad \gamma_6 = \beta_6 + b_1 \alpha_6,$$

$$\gamma_7 = \gamma_8 = \cdots = 1,$$

$$\gamma_7 > \gamma_6 > \gamma_5 > \gamma_4 > \gamma_3 > \gamma_2 > \gamma_1;$$

$$k_1 = 0, \quad k_2 = (1 - A_2)\beta_2, \quad k_3 = (1 - A_3)\beta_3$$

$$k_4 = (1 - A_4)\beta_4, \quad k_5 = (1 - A_5)\beta_5,$$

$$k_6 = (1 - A_6)\beta_6, \quad k_7 = k_8 = \cdots = 1$$

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$$k_7 > k_6 > k_5 > k_4 > k_3 > k_2 > k_1;$$

$$y_0 = \bar{y}\ , \qquad p_0 = \frac{(1 - a_2 + a_{10})y_0 - a_0 + a_1 i^*}{(a_9 + a_8 + a_7 + a_6 + a_5 + a_4 - a_3)}\ ,$$

$$m_0 = p_0 + b_0 - b_1 y_0 - bi^*, \quad w_0 = p_0;$$

$$T_0 = - P_0(a_9 + a_8 + a_7 + a_6 + a_5 + a_4 - a_3) - a_{10}y_{10};$$

$$g_1 = - a_3,$$

$$g_2 = (a_4 - a_3)(1 - \beta_2) - a_{10}\ \alpha_2$$

$$g_3 = (a_5 + a_4 - a_3)(1 - \beta_3) - (a_{10} + a_{11})\ \alpha_3$$

$$g_4 = (a_6 + a_5 + a_4 - a_3)(1 - \beta_4) - (a_{10} + a_{11} + a_{12})\ \alpha_4$$

$$g_5 = (a_7 + a_6 + a_5 + a_4 - a_3)(1 - \beta_5)$$

$$- (a_{10} + a_{11} + a_{12} + a_{13})\ \alpha_5$$

$$g_6 = (a_8 + a_7 + a_6 + a_5 + a_4 - a_3)(1 - \beta_6)$$

$$- (a_{10} + a_{11} + a_{12} + a_{13} + a_{14})\ \alpha_6$$

$$g_7 = g_8 = \cdot\ \cdot\ \cdot = 0.$$

We now examine equations (13)-(18), the adjustment paths of the model's variables following an unanticipated devaluation of the home currency.

If we restrict the price to approach a new long-run equillibrium monotonically, we should have β_2 positive by assuming $a_4 > a_3$: i.e., the positive effect on the trade balance due to the transactions made by the traders who anticipated the devaluation at time t-1 outweighs the initial perverse effect. As shown in equations (14), (15) and (16), the system is neutral in the long run with respect to an unanticipated devaluation; that is, prices, the money supply and wages increase in the same proportion as the exchange rate. From equations (13) and (18), real output and the trade balance are unchanged after six periods, or in the long run. The interest rate always equals the foreign rate because only anticipated devaluations affect it. The economy attains a new long-run equileibrium exactly six periods after the devaluation.

The adjustment paths in the short and intermediate runs, however, depend on the structural parameters. Generally, short-run equileibrium depends on the values of fixed parameters, but intermediate-run paths depend on the adjustments of variable parameters. The model has three variable parameters: the renewal rate of labor contracts, the relative price and the income effetcs on the trade balance owing to trade contracts. In other words, the interplay of labor and trade contracts plays a decisive role in the intermediate run. A more detailed explanation follows.

The value of the A_i's represents the percentage of labor contracts not renewed at period i. When labor contracts are renewed to maintain the constancy of the real wage, a higher nominal wage will be set matching the higher price level resulting from a devaluation. For instance, the value of A_2 represents the sum of the percentages of firms operation in the 2nd, 3rd, 4th, 5th, 6th periods of their old labor contracts in the second period. Hence, in Figure 1, $A_2 = c_6 + c_5 + c_4 + c_3 - c_2$ in period t+1, and c_1 in period t+1 represents the percentage of the firms operating in the first period of new labor contracts. The darkened area in Figure 2.1 represents the accumulated percentage of the firms renewing labor contracts by period t+i and increases over time until period t+6. By period 6, the wage adjustment to an unanticipated devaluation is completed by all firms. On the other hand, the A_i's decrease over time.

The monotonic decrease of the A_i's represents nominal wage increase

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as labor contracts are renewed gradually.

Because of the varying delivery lags of the trade contracts, the reaction of the trade balance to changes in relative prices and in income increases over time. For instance, the relative price effect increases from $a_5 + a_4 - a_3$ in period 3 to $a_6 + a_5 + a_4 - a_3$ in period 4, and the income effect increases from $a_{11} + a_{10}$ to $a_{12} + a_{11} - a_{10}$ during the same period. Both the sums of a_i's increase monotonically.

Using the feature of the three variable parameters, we discuss the price time path first. Since the values of the A_i's in the denominators of the β_i's decrease monotonically, the increasing renewal rates of labor

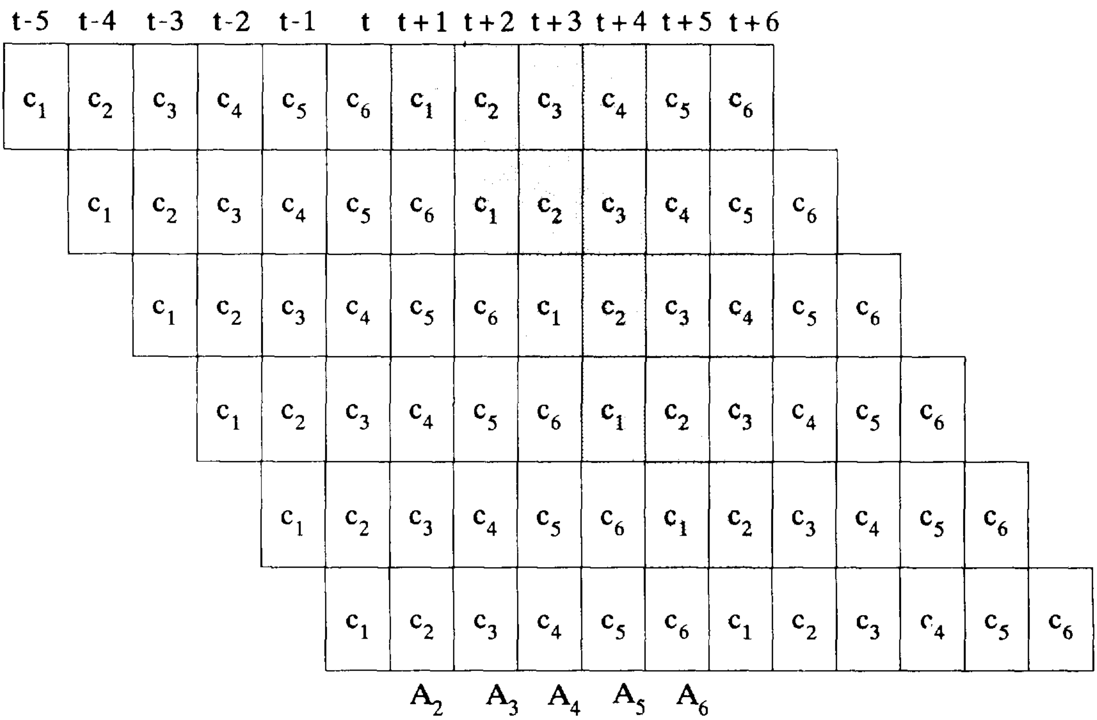

Figure 1. Six-period overlapping labor contracts.

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contracts raise the price gradually. In addition, the monotonic increase of the sum of the a_{3+i}'s in both the denominator and in the numerator of all β_i's implies the monotonic increase of the relative price effect on the trade balance lifts the price gradually. But the monotonic increase of the sum of the a_{9+i}'s implies the monotonic increase of the income effect on the trade balance dampens the price level. But over time, the positive effects on the price level from the gradual renewal of labor contracts and from relative price changes increasingly outweigh the negative effect from income changes. Because of the interplay of labor and trade contracts, the price level increases monotonically period by period to its long-run level.

For the output adjustment in the first period, since a devaluation works only through an increase in the value of imports in the first period, the trade balance decreases and this perverse effect depresses output. This negative effect on output of a devaluation is partially offset by a decrease in the real interest rate. The net effect on output is ambiguous. Output may decrease following a devaluation--a possibility pointed out by Krugman and Taylor (1978) and Cooper (1971). From the second period to the sixth period, the rate of change in output depends on the time path of the price level. If the price level increases gradually to its long-run level, output may grow increasingly and then decreasingly to the long-run level. But if the price level jumps in the second period, output may rise substantially in period one, ten decrease gradually to the initial equileibrium level by the sixth period.

Under fixed exchange rates and perfect capital mobility, the money supply is fully endogenous. In each period, the rate of increase of the money stock just equals the inflation rate and the rate of increase of money demand due to the increase in output. In the first period, the inflation rate is zero; therefore, the increase of the money supply is the same as that of the increase in money demand caused by the increase of output. After six periods, the accumulated proportional change in the money supply equals that of the devaluation.

For the wage adjustment, the rate of wage increase equals the current inflation rate times the renewal percentages of labor contracts. Since labor contracts are supposedly distributed evenly, the wage will increase steadily to the long run level.

Before we discuss the adjustment process for the trade balance, let us compare the values of the coefficient g_i's with each other, then we can easilly describe J-curve effects on the trade balance. If all denominators below are positive, the g's have the following relationships:

$$g_2 > g_1 \text{ if } a_4 > \frac{a_3^2 - a_3 A_2 a_{10} \frac{1}{d}}{\frac{1}{d}(1 - a_2)A_2 + a_3} \tag{19}$$

$$g_3 > g_2 \text{ if } a_5 > \frac{\frac{1}{d}\left[c_2(a_4 - a_3)^2 - a_{11}A_2A_3(a_4 - a_3)\right]}{\frac{1}{d^2}(1 - a_2 + a_{10})A_2A_3 - \frac{c_2}{d}(a_4 - a_3)} \tag{20}$$

$g_4 > g_3$ if

$$a_6 > \frac{\frac{1}{d}\left[c_3(a_5 + a_4 - a_3)^2 + a_{12}A_3A_4(a_5 + a_4 - a_3)\right]}{\frac{1}{d^2}(1 - a_2 + a_{10} + a_{11})A_3A_4 - \frac{c_3}{d}(a_5 + a_4 - a_3)} \tag{21}$$

$g_5 > g_3$ if

$$a_7 > \frac{\frac{1}{d}\left[c_4(a_6 + a_5 - a_4 - a_3)^2 + a_{13}A_4A_5(a_6 + a_5 + a_4 - a_3)\right]}{\frac{1}{d^2}(1 - a_2 + a_{10} + a_{11} + a_{12})A_4A_5 - \frac{c_4}{d}(a_6 + a_5 + a_4 - a_3)} \tag{22}$$

$g_6 > g_3$ if

$$a_8 > \frac{\frac{1}{d}\left[c_5(a_7 + a_6 + a_5 + a_4 - a_3)^2 + a_{14}A_5A_6(a_7 - a_6 + a_5 - a_4 - a_3)\right]}{\frac{1}{d^2}(1 - a_2 + a_{10} + a_{11} + a_{12} - a_{13})A_5A_6 - \frac{c_5}{d}(a_7 + a_6 + a_5 + a_4 - a_3)} \tag{23}$$

If the denominators above are negative, then g_{i+1} is smaller than g_i. since the denominators are more likely to be negative when more time has elapsed after a devaluation, the denominatiors are hardly ever positive for the fifth and sixth period after an unanticipated devaluatioin. This implies that the exchange rate effect on the trade balance will gradually decrease to zero and the effect on the trade balance of an unanticipated devaluation

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will be offset completely in the long run.

For the trade balance, a typical adjustment process is as follows. In the first period, there is a perverse effect. In the next two or three periods, since the nominal wage increases gradually but is still low and the supply and demand for imports and exports become more elastic, the trade balance improves gradually to the highest surplus level. During the last two or three periods, the effects from the wage increases outweigh those from the increases in relative price effects, and the trade balance gradually decreases to the initial level before the devaluation.

Using equations (19) to (23), We will identify some implausible and plausible time paths for the trade balance in the following four cases. Case A in figure 2 and case B in Figure 3 are the implausible cases. Case C in Figure 4 is the most likely if a_4 exceeds a_3. In reality, however, case D in Figure 5 may be the most likely.

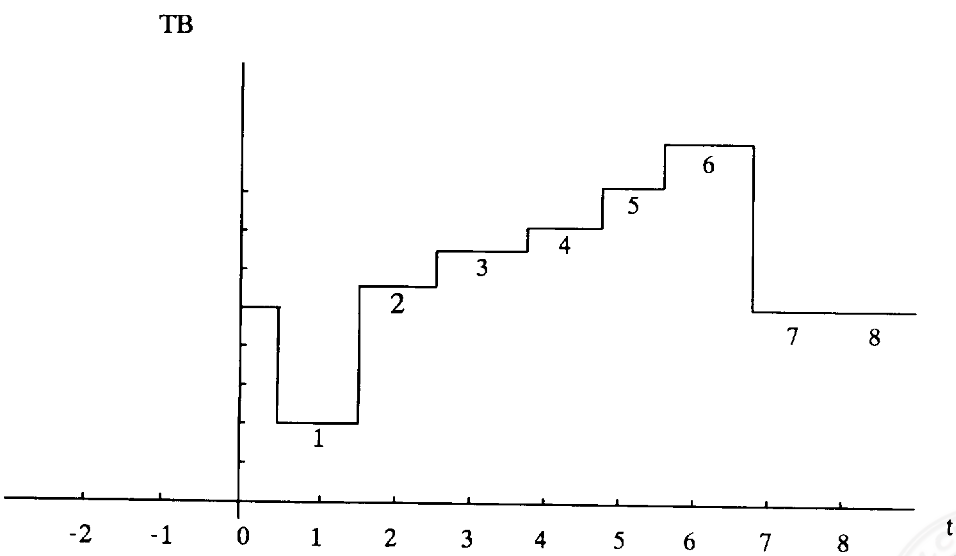

Figure 2. Case A: if $a_4 > a_3$ and conditions (19) – (23) hold.

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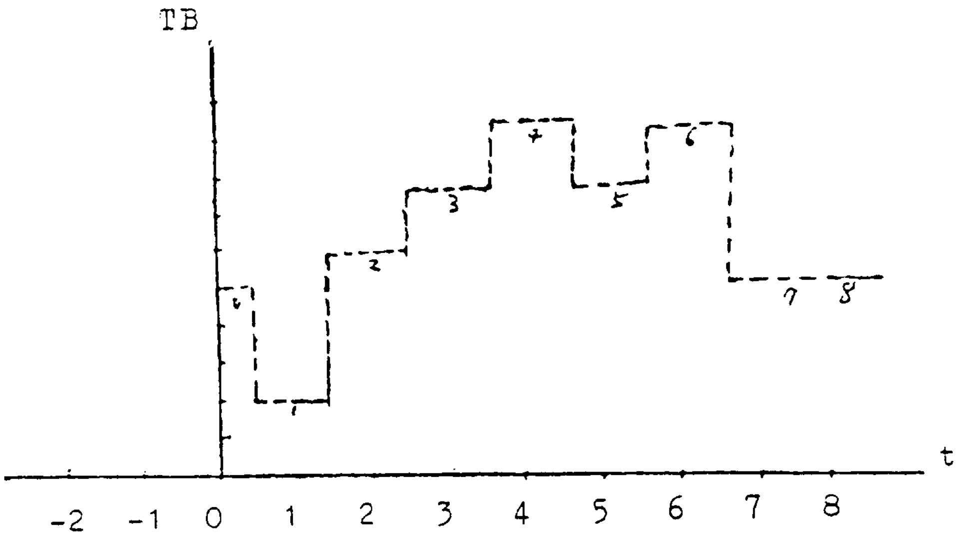

Figure 3. Case B: if $a_4 > a_3$ and conditions (19) – (21) and (23) hold, but (22) does not.

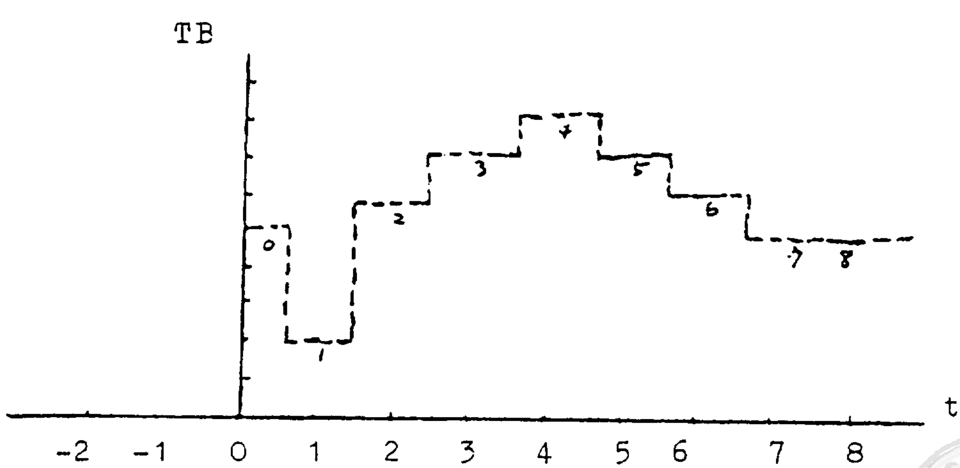

Figure 4. Case C: if $a_4 > a_3$ and conditions (19) – (21) hold, but (22) and (23) do not.

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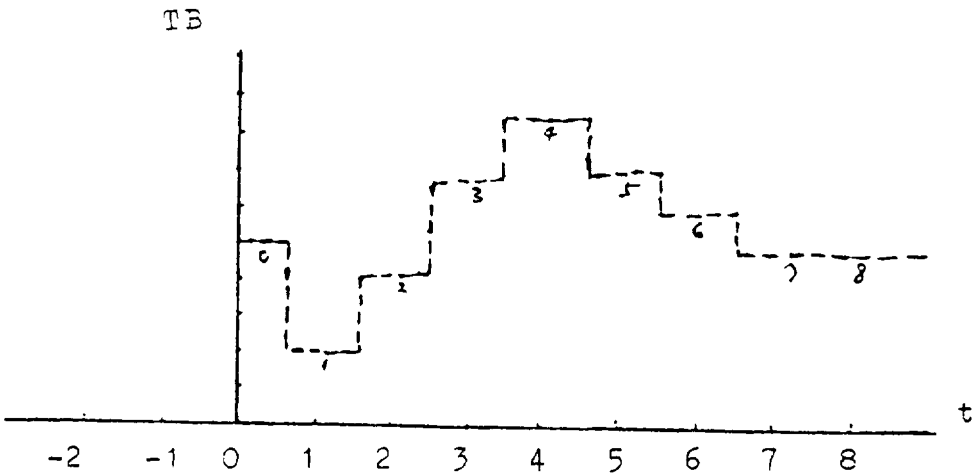

Figure 5. Case D: if $a_4 < a_3$, $a_5 + a_4 > a_3$ and conditions (20) and (21) hold, but (22) and (23) do not.

The implausibility of case A and case B follows from the implausibility of (22) and (23). As we mentioned before, (22) and (23) ard likely to fail since the negative effects from the wage increase outweigh the positive effects from the increase in the reactions for tradeables.

In the above analysis, the price level is assumed to move up monotonically to approach the long-run equillibrium. But if the anticipated relative price effect on the trade balance at period t-1 is too small to offset the initial perverse effect, or the improvements in the trade balance from the traders with an expectation at time t-1 are not enough to outweigh the initial perverse effect, a_3 will exceed a_4. If this happens, the price will go down in period 2 because $(1 - a_2 + a_{10}) \frac{A_2}{d} + (a_4 - a_3) > 0$ is assumed to ensure a unique solution for β_2.[11]

If $\beta_2 < 0$, then $\alpha_1 < 0$, $\alpha_2 < 0$, $\gamma_1 < 0$, $\gamma_2 < 0$, $g_2 < 0$. (24)

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Condition (24) implies that if $a_3>a_4$, an anticipated devaluation can lead to a reduction in output and the money supply and can generate a perverse effect on the trade balance. For the traders who form expectations at period t-2, t-3, t-4, t-5 and t-6, v_{t-1} is an unanticipated shock, but for the traders forming expectations at period t-1, v_{t-1} is an anticipated shock. Therefore, an anticipated shock could prolong the J-curve effect. This finding is contrary to the general result of the devaluation literature under rational expectations that only an unanticipated shock could affect the J curve.

4 Three special cases

4.1 Case One

We now proceed to compare the general solution above with solutions from three special case. In case one, all traders form their expectations at period t-1, i.e., $\bar{a}_4 = a_4+a_5+a_6+a_7+a_8+a_9$, $\bar{a}_{10}=a_{10}+a_{11}+a_{12}+a_{13}+a_{14}+a_{15}$. But labor contracts are the same as those in the general model. Therefore, case one incorporates short-term trade contracts with long-term labor contracts.

The solution for case one is the following:

$$\beta_1=0$$

$$\beta_2=\frac{\bar{a}_4-a_3}{\frac{1}{d}(1-a_2+\bar{a}_{10})A_2+(\bar{a}_4-a_3)}$$

$$\beta_3=\frac{\bar{a}_4-a_3}{\frac{1}{d}(1-a_2+\bar{a}_{10})A_3+(\bar{a}_4-a_3)}$$

$$\beta_4=\frac{\bar{a}_4-a_3}{\frac{1}{d}(1-a_2+\bar{a}_{10})A_4+(\bar{a}_4-a_3)}$$

$$\beta_5=\frac{\bar{a}_4-a_3}{\frac{1}{d}(1-a_2+\bar{a}_{10})A_5+(\bar{a}_4-a_3)}$$

$$\beta_6=\frac{\bar{a}_4-a_3}{\frac{1}{d}(1-a_2+\bar{a}_{10})A_6+(\bar{a}_4-a_3)}$$

$$\beta_7=\beta_8=\cdot\ \cdot\ \cdot=1,$$

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$$\beta_7 > \beta_6 > \beta_5 > \beta_4 > \beta_3 > \beta_2, \quad \beta_1 = 0;$$

$$\alpha_1 = \frac{a_1 \beta_2 - a_3}{1 - a_2} \ \substack{> \\ (<)} \ 0, \quad \alpha_2 = \frac{1}{d} A_2 \beta_2$$

$$\alpha_3 = \frac{1}{d} A_3 \beta_3, \quad \alpha_4 = \frac{1}{d} A_4 \beta_4, \quad \alpha_5 = \frac{1}{d} A_5 \beta_5$$

$$\alpha_6 = \frac{1}{d} A_6 \beta_6, \quad \alpha_7 = \alpha_7 = \cdot \cdot \cdot = 0;$$

$$\gamma_1 = b_1 \alpha_1, \quad \gamma_2 = \beta_2 + b_1 \alpha_2, \quad \gamma_3 = \beta_3 + b_1 \alpha_3,$$

$$\gamma_4 = \beta_4 + b_1 \alpha_4, \quad \gamma_5 = \beta_5 + b_1 \alpha_5, \quad \gamma_6 = \beta_6 + b_1 \alpha_6,$$

$$\gamma_7 = \gamma_8 = \cdot \cdot \cdot = 1;$$

$$\gamma_7 > \gamma_6 > \gamma_5 > \gamma_4 > \gamma_3 > \gamma_2 > \gamma_1;$$

$$k_1 = 0, \quad k_2 = (1 + A_2) \beta_2, \quad k_3 = (1 + A_3) \beta_3,$$

$$k_4 = (1 + A_4) \beta_4, \quad k_5 = (1 + A_5) \beta_5,$$

$$k_6 = (1 + A_6) \beta_6, \quad k_7 = k_8 = \cdot \cdot \cdot = 1;$$

$$k_7 > k_6 > k_5 > k_4 > k_3 > k_2 > k_1;$$

$$g_1 = - a_3$$

$$g_2 = (\bar{a}_4 - a_3)(1 - \beta_2) - \bar{a}_{10} \alpha_2,$$

$$g_3 = (\bar{a}_4 - a_3)(1 - \beta_3) - \bar{a}_{10} \alpha_3,$$

$$g_4 = (\bar{a}_4 - a_3)(1 - \beta_4) - \bar{a}_{10} \alpha_4,$$

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$$g_5 = (\bar{a}_4 - a_3)(1 - \beta_5) - \bar{a}_{10}\,\alpha_5,$$

$$g_6 = (\bar{a}_4 - a_3)(1 - \beta_6) - \bar{a}_{10}\,\alpha_6,$$

$$g_7 = g_8 = \cdot\cdot\cdot = 0$$

$$g_2 > g_3 > g_4 > g_5 > g_6 > g_7 \text{[12]};$$

$$y_0 = \bar{y}, \quad p_0 = \frac{(1 - a_2 + \bar{a}_{10})y_0 - a_0 + a_1 i^*}{(\bar{a}_4 + a_3)} \tag{25}$$

$$m_0 = p_0 + b_0 + b_1 y_0 - b_1 i^*, \quad w_0 = p_0$$

$$T_0 = -\,p_0(a_4 - a_3) - a_{10} y_0;$$

In the long run, this special case produces the same results as the general case. The system is also neutral with respect to an unanticipated devaluation. The price level, the money supply and the wage all increase in the same proportion as the exchange rate. Output and the trade balance are unchanged. The interest rate always equals the foreign rate. The whole economy attains a new long-run equileibrium exactly six periods after the devaluation.

In the short and intermediate runs, however, the adjustment processes for this case differ from those for the general case. Since all agents are assumed to form their expectations at period t-1, the trade balance equation used in case one is equation (2). The value of a_4 of equation (2) is much larger than a_4 of equation (3). The value of a_4 is fixed over time, that is, the relative price effect on the trade balance is constant over time or exports and imports react instantaneously to changes in exchange rate. Due to the large and fixed value of a_4, the values of parameters β_2, α_2, γ_2, k_2 and g_2 are much higher than those in the general case, but the differences between them become smaller and smaller and approach zero in period 6.

The price level is unchanged in the first period, but jumps to a high level in period 2, then increases monotonically to the long-run level. The jump is due to the huge value of $\bar{a}_4$ caused by the special specification of trade contracts, and the monotonic increases are due to the gradual renewals of labor contracts.

Output in the first period may jump up substantially because the expected real interest rate effect outweighs the initial perverse effect, a result of the expected price jump in period 2. After period 1, output may decrease monotonically to the initial level. Therefore, an unanticipated devaluation is not likely to have contractionary effects on output in case one.

The adjustment processes for the money supply and wages are almost the same as those of the general case except that the money supply may not decrease in period 1.

Finally, let us turn to the adjustment paths for the trade balance. After the initial perverse effects, the large value of g_2, caused by $\bar{a}_4$, turns the trade balance into the highest surplus in period 2 after an unanticipated devaluation and the trade balance decreases monotonically thereafter to the initial level. Hence, it is impossible for an anticipated devaluation to prolong the J-curve effects for case one. This is why the recent devaluation literature under rational expectatins suggests that only an unanticipated devaluation can generate J-curve effects. The shape of an J-curve in case one is illustrated in figure 6.

To reiterate, the shortcomings of case one are due to the special specification of trade contracts with only a one-period lag. Only one type of J-curve can be generated from case one. Therefore, case one is too special to explain the general shapes of J-curves observed for many countries.

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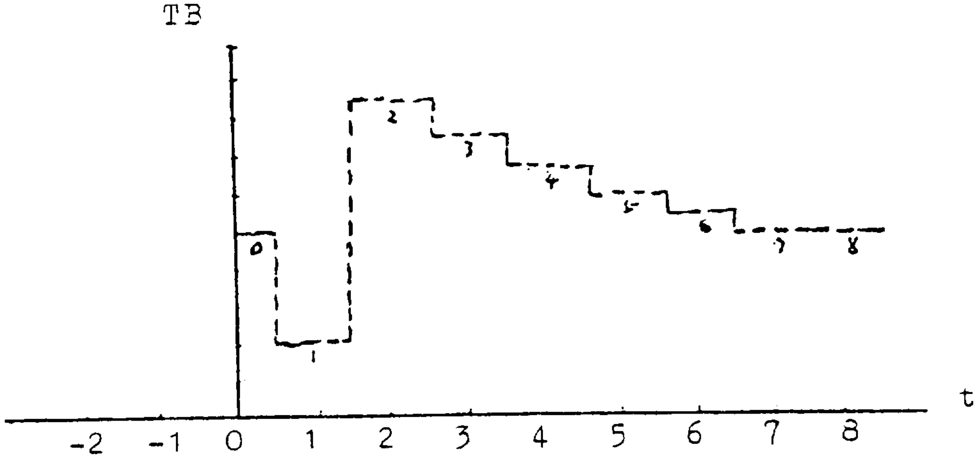

Figure 6. The J-curve shape for case one.

4.2 Case Two

Next, we discuss another special case which also uses equation (2) as the trade balance equation. All trade contracts are assumed to have only a one-period lag, that is, all traders form expectations at period t-1. All labor contracts are supposed to run for two periods, that is, $c_3 = c_4 = c_5 = c_6 = 0$, $c_1 + c_2 = 1$. The general solutions in section 2 will be reduced to the following:

$$\beta_1 = 0$$

$$\beta_2 = \frac{\bar{a}_4 - a_3}{\frac{1}{d}(1 - a_2 + \bar{a}_{10})c_2 + (\bar{a}_4 - a_3)},$$

$$\beta_3 = \beta_4 = \cdot \cdot \cdot = 1;$$

$$\alpha_1 = \frac{\bar{a}_1 \beta_2 - a_3}{(1 - a_2)} \overset{>}{(<)} 0, \qquad \alpha_2 = \frac{1}{d} c_2 \beta_4$$

$$\alpha_3 = \alpha_4 = \cdot \cdot \cdot = 0;$$

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$$\gamma_1 = b_1 \alpha_1, \quad \gamma_2 = \beta_2 + b_1 \alpha_2,$$

$$\gamma_3 = \gamma_4 = \gamma_5 = \cdots = 1;$$

$$k_1 = 0, \quad k_2 = c_1 \beta_2,$$

$$k_3 = k_4 = \cdots = 1;$$

$$g_1 = -a_3 ,$$

$$g_2 = (\bar{a}_4 - a_3)(1 - \beta_2) - a_{10} \alpha_2,$$

$$g_3 = g_4 = g_5 = \cdots = 0;$$

$$y_0 = c_0, \ w_0 = p_0, \ p_0 = \frac{(1 - a_2 + \bar{a}_{10})y_0 - a_0 + a_1 i^*}{(\bar{a}_4 - a_3)},$$

$$m_0 = p_0 + b_0 + b_1 y_0 - b_2 i^*, \quad T_0 = -p_0(\bar{a}_4 - a_3) - \bar{a}_{10} y_0;$$

An examination of the solutions for case two yields the follwing results. In the long run, case two is identical to the general case and case one. That is, the system is neutral with respect to an unanticipated devaluation. In a word, the trade balance and output and interest rate are unchanged, and the price level, money supply and wage increase in the same proportion as the exchange rate. The economy completes the entire adjustment pocess in two periods after the devaluation.

In this case, a one-period intermediate run is too short to describe properly the entire adjustment process. In the short run, the adjustment processes are the same as in case one, but the pace of adjustment is faster. The value of $\bar{a}_4$ is the same in cases one and two, but the values of c_1 and c_2 in case two are much higher than in case one. Since c_3, c_4, c_5 and c_6 are set to zero and $c_1 + c_2 = 1$, the values of c_1 and c_2 for case two could be three times those in case one and in the general case. The large

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values of c_1 and c_2 allow the wage to increase faster than in case one because more labor contracts will be renewed in period 2. Due to the large values of a_4, c_1 and c_2 resulting from the short trade and labor contracts, prices, the money supply and wages are higher than those in case one and much higher than those in the general case. Output and the trade balance in period 2 are smaller than those in case one, but still higher than those in the general case.

In the first period after the devaluation, prices and wages are unchanged. Output generally will increase since the large expected real interest rate effects could outweigh the initial perverse effects. The money supply increases quickly, and the trade balance deteriorates.

In the second period, prices and wages jump to very high levels, but the price jump is not as high as the increase in the money supply. Output is still higher than the long-run level. The trade balance rises instantaneously to the highest surplus. As in case one, it is impossible for an anticipated devaluation to prolong the J-curve effects. The J-curve in case two is illustrated in Figure 7.

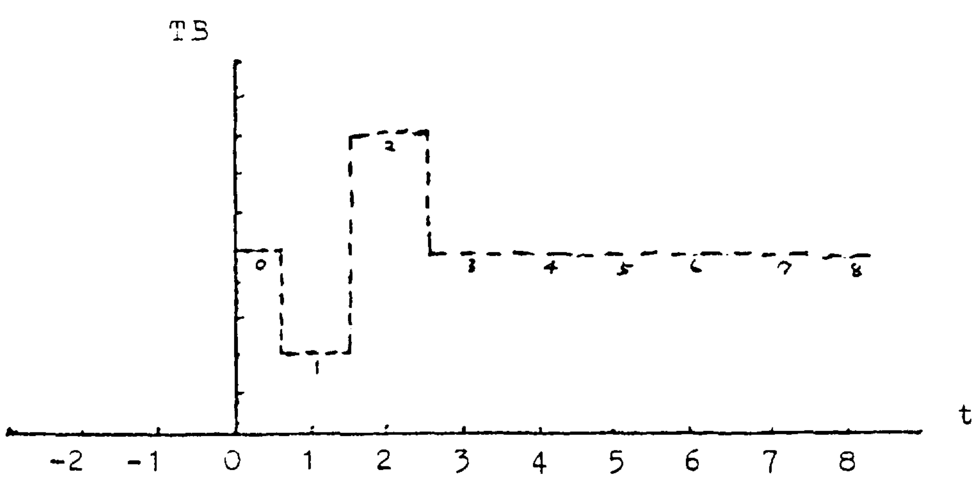

Figure 7. The J-curve shape for case two.

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Finally, let us point out the defects of case two. Case tow shared the same problems as case one of the fixed relative price effect on the trade balance due to short-term trade contracts, In addition, as a result of short-term labor contracts, case two overlooks the intermediate run. The problems with both cases have permeated the devaluation literature. By incorporating long-term trade and labor contracts, the general case removes these shortcomings.

4.3 Case Three

For some countries, labor contracts may last 2 or 3 years while trade contracts generally last 1 year at most. Accordingly, in case three all labor contracts are assumed to run for six periods evenly while trade contracts last two periods at most. That is, some trade contracts have a one-period delivery lag and the others have a lag of two periods. This implies that $a_6 = a_7 = a_8 = a_9 = 0$, $a_{12} = a_{13} = a_{14} = a_{15} = 0$. Therefore, the general solution in section 2 reduces to the following:

$$\beta_1 = 0$$

$$\beta_2 = \frac{a_4 - a_3}{\frac{1}{d}(1 - a_2 + a_{10})A_2 + (a_4 - a_3)}$$

$$\beta_3 = \frac{a_5 + a_4 - a_3}{\frac{1}{d}(1 - a_2 + a_{10} + a_{11})A_3 + (a_5 + a_4 - a_3)}$$

$$\beta_4 = \frac{a_5 + a_4 - a_3}{\frac{1}{d}(1 - a_2 + a_{10} + a_{11})A_4 + (a_5 + a_4 - a_3)}$$

$$\beta_5 = \frac{a_5 + a_4 - a_3}{\frac{1}{d}(1 - a_2 + a_{10} + a_{11})A_5 + (a_5 + a_4 - a_3)}$$

$$\beta_7 = \beta_8 = \cdots = 1;$$

$$\alpha_1 = \frac{a_1 \beta_2 - a_3}{1 - a_2} \underset{(<)}{>} 0 \qquad \alpha_2 = \frac{1}{d} A_2 \beta_2$$

$$\alpha_3 = \frac{1}{d} A_3 \beta_3 \qquad \alpha_4 = \frac{1}{d} A_4 \beta_4 \qquad \alpha_5 = \frac{1}{d} A_5 \beta_5$$

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$$\alpha_6 = \frac{1}{d} A_6 \beta_6 \quad \alpha_7 = \alpha_8 = \cdot \cdot \cdot = 0;$$

$$\gamma_1 = b_1 1 \alpha_1, \quad \gamma_2 = \beta_2 + b_1 \alpha_2 \quad \gamma_3 = \beta_3 + b_1 \alpha_3$$

$$\gamma_4 = \beta_4 + b_1 \alpha_4, \quad \gamma_5 = \beta_5 + b_1 \alpha_5, \quad \gamma_6 = \beta_6 + b_1 \alpha_6,$$

$$\gamma_7 = \gamma_8 = \cdot \cdot \cdot = 1,$$

$$\gamma_7 > \gamma_6 > \gamma_5 > \gamma_4 > \gamma_3 > \gamma_2 > \gamma_1 ;$$

$$k_1 = 0, \quad k_2 = (1 - A_2) \beta_2, \quad k_3 = (1 - A_3) \beta_3,$$

$$k_4 = (1 - A_4) \beta_4, \quad k_5 = (1 - A_5) \beta_5, \; k_6 = (1 - A_6) \beta_6,$$

$$k_7 = k_8 = \cdot \cdot \cdot = 1;$$

$$k_7 > k_6 > k_5 > k_4 > k_3 > k_2 > k_1;$$

$$g_1 = - a_3$$

$$g_2 = (a_4 - a_3)(1 - \beta_2) - a_{10} \alpha_2,$$

$$g_3 = (a_5 + a_4 - a_3)(1 - \beta_3) - (a_{10} + a_{11}) \alpha_3,$$

$$g_4 = (a_5 + a_4 - a_3)(1 - \beta_4) - (a_{10} + a_{11}) \alpha_4$$

$$g_5 = (a_5 + a_4 - a_3)(1 - \beta_5) - (a_{10} + a_{11}) \alpha_5$$

$$g_6 = (a_5 + a_4 - a_3)(1 - \beta_6) - (a_{10} + a_{11}) \alpha_6$$

$$g_7 = g_8 = \cdot \cdot \cdot = 1;$$

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$$y_0 = \bar{y}, \quad p_0 = \frac{(1 - a_2 + \bar{a}_{10})\bar{y}^2 - a_0 + a_1 i^*}{(a_5 + a_4 + a_3)}$$

$$m_0 = p_0 + b_0 + b_1 y_0 - b_1 i^*, \quad w_0 = p_0;$$

$$T_0 = - p_0(a_5 + a_4 - a_3) - a_{10} y_0.$$

In the long run, case three produces the same results as the general case. We will not repeat them here. In the short and intermediate run, case three generally generates the adjustment paths close to those generated by the general case in section 3. Therefore, we will not reiterate them either.

Two features distinguish case three. The first is that the pace of adjustment for the entire economy during the first three periods is generally faster than that of the general case, but it is slower after period 3. This is due to the specification of trade contracts in case three. Under the specification, the reaction of the trade balance to changes in relative prices and income is faster than those in the general case.

The second feature is that the trade balance reaches its highest position in period 3 for case three while in the general case the trade balance peaks in period 4. Two plausible time paths for the trade balance are in Figure 8 and 9. The J-curve in Figure 8 is the most likely for case 3 if a_4 exceeds a_3. But if a_3 exceeds a_4, the path in Figure 9 may be the most likely one. Actually, the J-curves in Figures 8 and 9 are like those in Figures 4 and 5. Accordingly. the time paths for the trade balance generated by case three may be also most likely.

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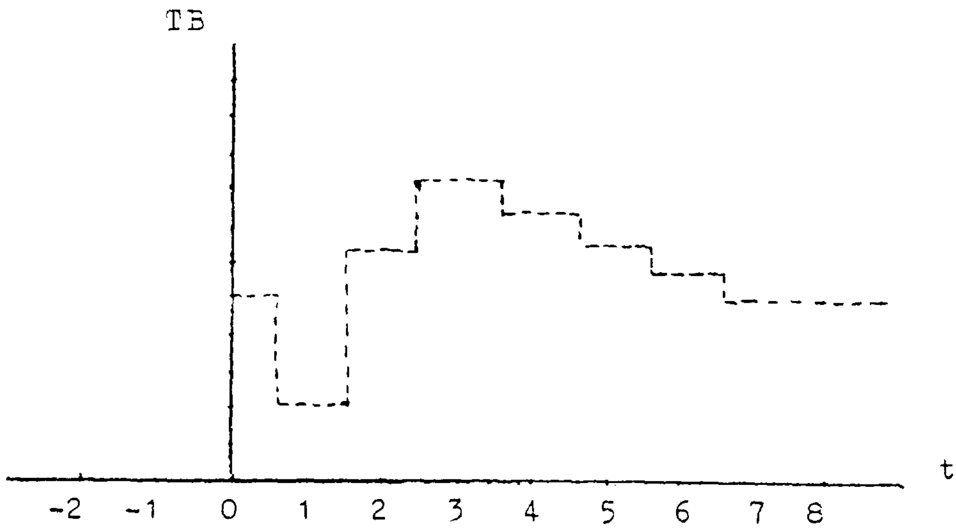

Figure 8. A J-curve shape for case three.

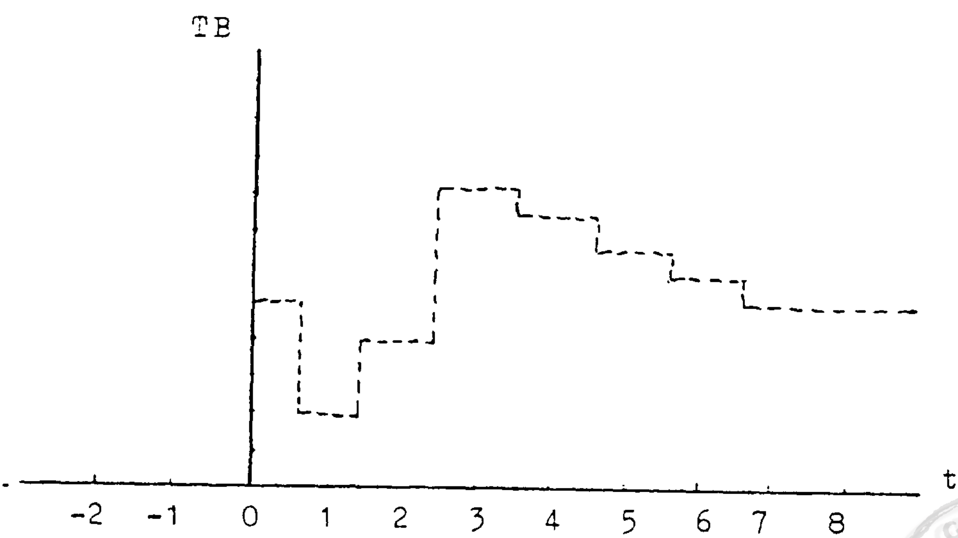

Figure 9. A J-curve shape for case three.

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5. Conclusions

The model incorporating the long-term trade contracts and labor contracts in this paper generates a rich variety of gradual adjustment processes. This provides a strong contrast to the stark simplicity of the instantaneous adjustment in the models in which the trade balance is assumed to be like equation (1) and (2). The most serious deficiency of the equations is the assumption that export and import values react relatively fast, instantaneously in some case, to changes in relative prices. However, in reality, this rection is distributed over time. It is quite likely that the short-run reaction is very slow because traders are not able to react to an unanticipated devaluation very quickly. In the intermediate run, the adjustment processes may be significantly influenced by the consecutive and gradual renewals of labor contracts and the trade contracts with different delivery lags. The long-run reaction is zero because, in the long run, the entire economy is neutral.

The first two special cases may be justified from the viwepoint of the long run and the short run, but they fail to account for the intermediate run. Case D illustrated in Figure 5 may be most likely, and a small relative price effect on the trade balance in initial periods may prolong the J-curve effects on the trade balance. An unecpected devaluation has a contemporaneously contractionary effect on output if the J-curve effect dominates the expected real interest rate effect in the short run.

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Notes

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1 The Marshall-Lerner condition states that a devaluation improves the trade balance if and only if the sum of the domestic and foreign elasticities of demands for imports exceeds unity under the assumption that the elasticities of supplies of exportables and importables are infinite and that the trade account is initially balanced.

2 The literature on the J-curve includes several other papers. Levin (1983, 1985) used Williamson's equation (1), while Ueda(1983) followed Driskill's equation (2). Currie(1985) replaced the term for the expected relative price in equation (2) by a distributed lag of the reclative price, but kept the current relative price term of equaion (2). All of them share the same problem of constant price elasticity of the trade balance over time.

3 In addition, we could find the following phenomenon from the three devaluations. In the short run and long run, the effects of a devaluation were the same in nature for U.K., Korea and Nepal, that is, a perverse effect in the short run and neutrality in the long run. But the length of the intermediate run is different, very short for Nepal and long for the U.K. and Korea.

4 for references, see Magee (1974, p. 132).

5 A detailed explanation of the entry lag was given by Magee (1974, p. 131). The entry lag may comprise at least three elements: unloading the ship, the ten-day grace period for filing the entry form for goods entered under immediate delivery, and the transshipment time between the port of importation and the port at which the goods are entered. For example, goods that come through Houston for an importer in Toledo, Ohio, may be transshipped to the Toledo port of entry for his convenience in paying the estimated duties and bond.

6 Grassman (1973) found that roughly two-thirds of contracts were in

the seller's currency and one-fourth in purchaser's.

7 Because we assume that all contracts are written in terms of the pro ducer's currency, the value of the trade balance equals $P_xX - eP_mM$. Devaluing the domestic currency implies an increase in e, and hence an increase in the value of imports. As a result, the trade balance deteriorates if X and M remain unchanged.

8 More importantly, it makes the intermediate-run analysis possible.

9 Generally, the rational expectational equations have an infinite number of solutions. If the number of characteristic roots which exceed unity equals the order of the rational expectations model, we can get a unique solution for the free parameters. The denominators of all β_i's should be positive because the characteristic root is assumed greater than unity in order to get a unique solution for the β_i's.

10 If J-curve effects are dominated, the value of g_i's is positive. For instance,

$$g_6 = \frac{(a_8 + a_7 + a_6 + a_5 + a_4 - a_3)\frac{A_6}{d} - (1 - a_2)}{\frac{1}{d}(1 - a_2 + a_{10} + a_{11} + a_{12} + a_{13} + a_{14}) - (a_8 + a_7 + a_6 + a_5 + a_4 - a_3)}$$

Since both denominator and numerator are positive, g_6 is positive.

11 See note 9.

12 It is easy to prove the relationship shown in equatio (25). For instance,

$$g_2 - g_3 = \frac{(\bar{a}_4 - a_3)^2 \quad - (1 - a_2)}{[(1 - a_2 + \bar{a}_{10})A_2 + (\bar{a}_4 - a_3)][(1 - a_2 + \bar{a}_{10})A_3 - (\bar{a}_4 - a_3)]} > 0$$

Similarly, we can get $g_3 > g_4$, etc.

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