DEVALUATION AND THE J-CURVE: SOME EVIDENCE FROM LDCs

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Abstract—Within the international trade literature it is not uncommon to find arguments about whether devaluation will improve the trade balance. It is argued that the flows of goods respond only with time lags to changes in the exchange rate. The J-Curve term is used to describe the movement over time of the trade balance: it may deteriorate at first and improve only with time lags. This paper presents a method by which one could detect the existence of the J-Curve. The method is applied to four developing countries. The empirical evidence supports the pattern of movement described by the J-Curve.

A major policy option for a country facing a persistent balance of payments deficit is said to be devaluation of its currency. Within the international trade literature it is not uncommon to find arguments about whether devaluation will improve the trade balance or the balance of payments. For example, proponents of the elasticities approach describe the necessary and sufficient conditions for an improvement in the trade balance in terms of elasticities of demand and supply referred to as the Marshall-Lerner condition. While there is abundant empirical evidence to suggest that these conditions are indeed met (at least for industrial countries), there have been circumstances under which devaluation has not been successful. For example, one might wonder why the U.S. trade balance deteriorated so much in 1972 despite the devaluation of the dollar in 1971. This unfavorable effect of devaluation on the trade balance is termed the “J-Curve” phenomenon.

1 Proponents of the absorption approach (e.g., Alexander, 1952) describe how devaluation may change the terms of trade, increase production, and switch expenditures from foreign to domestic goods, thus improving the trade balance. International monetarists argue that devaluation reduces the real value of cash balances and/or changes the relative price of traded and nontraded goods, thus improving both the trade balance and the balance of payments.

2 For an estimate of the elasticities, see Houthakker and Magee (1969) and Warner and Kreinin (1983). The former study provides the elasticities estimates under fixed exchange rates and the latter under floating rates.

REFERENCES


because of the path the balance of trade would follow over time.

The J-Curve phenomenon has been explained by several factors. Krueger (1983) has argued that the phenomenon emanates from the fact that at the time an exchange rate change occurs, goods already in transit and under contract have been purchased, and the completion of those transactions dominates the short-term change in the trade balance. Therefore the trade balance deteriorates first, but after the passage of time (during which the elasticities have a chance to increase) it begins to improve. Magee (1973) has attributed the phenomenon to the fact that the rapid increase in domestic activity (measured by real income) relative to activity abroad may swamp any favorable effects that the devaluation might generate. He characterized the phenomenon as consisting of a period during which contracts already in force in specified currencies dominate the determinants of the current account. Over time, new contracts made after the devaluation begin to dominate, and the “pass-through” of the devaluation or depreciation is affected. Finally, Junz and Rhomberg (1973) have argued that the expansion of exports and the retardation of imports occur only after substantial lags. They have identified at least five lags in the process between changes in exchange rates and their ultimate effects on real trade: lags in recognition of the changed situation, in the decision to change real variables, in delivery time, in the replacement of inventories and materials, and in production. Their empirical evidence supports lags of up to five years in the effects of exchange rate changes on market shares of countries in world trade.

While numerous authors, such as Cooper (1971), Connolly and Taylor (1972), Laffer (1974) and Salant (1974), have investigated the effects of devaluation on the trade balance and on the balance of payments, none of them has taken into account other than exchange rate that might affect those balances. In his recent study, Miles (1979) related changes in the trade balance and in the balance of payments to changes in the exchange rate, income, and money supply. Using annual data for 14 countries (most of them industrial) over the period 1956–72, he concluded that in the absence of other variables, i.e., income and money, there was no overwhelming evidence of an improvement in either account. However, when all variables were included in the regression analysis, it was found that the devaluation did not improve the trade balance but improved the balance of payments.

The purpose of this paper is to examine the statistical relationship between devaluation and the trade balance of four developing countries, using quarterly data on the relevant variables for the period 1973–1980. More specifically, the paper tries to shed some empirical light on the validity of the J-Curve phenomenon considering the experiences of Greece, India, Korea and Thailand, which have profoundly different exchange rate regimes. India and Thailand are selected as the ones that pegged their currency to the U.S. dollar during our period of study; Korea had a fixed rate against the U.S. dollar with two devaluations until 1979, and a floating rate since 1979. Finally, Greece was on a managed float with daily announcements of the exchange rate level.

The plan of the paper is as follows: Section I describes the model used in this study and summarizes the theory behind it. Section II discusses the results obtained from estimating the model. The implications of the results and the conclusion reached are set forth briefly in section III. Data definitions and sources are listed in the appendix.

I. The Trade Balance Equation

Following Krueger (1983, p. 33) the multiplier-based analysis of the effects of exchange-rate change on trade balance is developed as

$$ TB = F(Y, E/P) \),

where \( TB \) is the trade balance, \( Y \) is the level of real output, \( E \) is the exchange rate and \( P \) is the domestic price level.

In this paper equation (1) is extended in the following manner. First, world income \((YW)\) is included in order to take account of potential repercussion effects. Second, in order to give some monetary flavor to our equation, the level of domestic high powered money \((M)\) together with that of the rest of the world \((MW)\) is also included. Finally, since it is the central concern of this paper to assess the J-Curve phenomenon, a lag structure is imposed on the exchange rate variable. Taking into account these extensions, the linear form of equation (1) inclusive of a disturbance term \((u)\) is written as

$$ TB_t = a_0 + a_1 Y_t + a_2 YW_t + a_3 M_t + a_4 MW_t,$$

$$ + \sum_{i=0}^{n} \beta_i \left( E/P \right)_{t-i} + u_t \) \)

Several comments are in order with regard to equation (2). First, the trade balance \((TB)\) is defined as the excess of exports over imports. Second, following Almon, it is assumed that distributed lag coefficients lie on a polynomial curve of third degree without any constraints. Finally, the long-run or steady state effects of depreciation are ordinarily derived from the esti-

3 Connolly and Taylor have tried to relate the improvement in the balance of payments to domestic credit creation.

4 1973 is chosen as the first year because of a move to a floating rate system in that year, and 1980 was the last year for which data on all variables were available.
mates yielded by equation (2) as the sum of the lag coefficients (e.g., $\sum \beta_i$).

With regard to the sign of the coefficients in equation (2), it is expected that $a_1 < 0$. This is due to the fact that a rise in real income will increase imports, which in turn will deteriorate the trade balance. However, Magee (1973) has argued that the sign of $a_1$ could easily be positive because imports are the difference between domestic consumption and domestic production. As real income rises the domestic production of importables could rise faster than consumption so as to reduce the volume of imports. By the same token $a_2$ is expected to be either positive or negative, too.

Paraphrasing Miles (1979, pp. 604–605), the monetary variable is not defined to be $M_1$ or $M_2$. Rather it is defined as the level of the domestic portion of high-power money that is under the control of the monetary authorities. It is argued that the effect of this variable on the trade balance depends on several factors. According to Johnson (1972), an increase in money supply leads to an increase in the level of real balances. Individuals perceive their wealth to rise, causing the level of expenditures to increase relative to income and the trade balance to deteriorate, therefore $a_1 < 0$. Miles (1979) has argued that this negative relation may not be observed for at least three reasons. First, nominal money balances may be only a small fraction of total wealth. Second, money may not be perceived as net wealth by the private sector. In this case there is no real balance effect and the trade balance does not deteriorate. Finally, response of expenditures to changes in wealth could be insignificant.

Since the foreign money supply ($MW$) exerts effects opposite to those of the domestic money supply, $a_3$ is expected to be positive.

Defined as units of foreign currency per unit of domestic currency the expected sign of the $E/P$ parameter is negative. As $E/P$ declines (i.e., domestic currency depreciates), imports are discouraged and exports encouraged; therefore, the trade balance is expected to improve. Thus $\beta < 0$.

### II. Results of the Estimation

Equation (2) was estimated for four developing countries, using quarterly data for the 1973–80 period. In each case all possible Almon lag structures on the exchange rate were explored with the maximum of 12 lags. In the absence of undisputed econometric standards for choosing among alternative results with the same functional forms, we then looked to the signs, significance, and behavior of the coefficients in the distributed lags on the exchange rate to choose the final equations. Table 1 presents the most satisfactory results and details of the estimated lag structures.

As was discussed earlier, it is expected that the sign of the coefficient of the exchange rate variable will be negative. Therefore an initially positive sign followed by a negative one on the distributed lag coefficients would be consistent with the J-Curve phenomenon. This is exactly the case in the results for the trade balance of all countries except Thailand. The only difference is in the duration of the deterioration and then improvement of the trade balance. For example, while it takes 2 quarters for the trade balance of Greece to deteriorate after devaluation, it only takes 3 quarters for Korea and 4 quarters for India. Unlike these three countries, the trade balance of Thailand improves for 5 quarters subsequent to devaluation and then it starts to deteriorate.

Besides the assessment of the J-Curve, some other features of the results deserve mention. First, the long-run effect of devaluation is the same as its short-run effect, i.e., not only the trade balance of Greece, India and Korea deteriorates in the short run subsequent to devaluation, it deteriorates in the long run, too. The opposite is true for Thailand.

Second, in the results for Korea a dummy variable ($D$) was included in order to take account of a sudden change in the Korean exchange rate regime. As the results indicate, the estimated coefficient of the dummy variable is significant at the 5% level. This indicates that an $X\%$ devaluation in one quarter has a profoundly different effect on the trade balance depending on whether it represents a single parity change or a series of small daily adjustments. This is in part true because the latter is more likely to be anticipated by the market.

Third, the domestic income variable ($Y$) has the expected sign and is significant at the usual 5% level only in the results for Korea. The world income variable also has the expected sign; however, it is significant only in the results for Greece and India.

Fourth, the domestic monetary variable has the expected negative sign in the results for Greece and Korea and is significantly different from zero in the case of Greece and Thailand. The world monetary variable has the expected positive sign only in the case of Korea and is significant in the results for India and Thailand.

### III. Summary and Conclusion

Although the elasticities condition is no longer interpreted to imply that devaluation might fail, there is an alternative basis on which questions have been raised about the short-term effects of exchange-rate changes on the trade balance. Although it is based more on empirical observations than on theory, it has important theoretical implications. That is, it is quite possible that flows of goods respond only with time lags to changes in the exchange rate. The J-Curve term is used to describe the movement over time of the trade balance: It may deteriorate at first and improvement might come later.
### Table 1. — Coefficient Estimates of the Trade Balance Equation

**GREECE**

<table>
<thead>
<tr>
<th>Lag Quarters</th>
<th>Constant</th>
<th>Y</th>
<th>YW</th>
<th>M</th>
<th>MW</th>
<th>E/P</th>
<th>D</th>
<th>R²</th>
<th>F</th>
<th>D.W.</th>
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<tr>
<td>0</td>
<td>62.74</td>
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<td>0.73</td>
<td>-0.695</td>
<td>-0.412</td>
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<td>0.85</td>
<td>26.31</td>
<td>1.6028</td>
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<td>(0.96)</td>
<td>(1.65)</td>
<td>(2.25)</td>
<td>(0.68)</td>
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**INDIA**

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<th>Lag Quarters</th>
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<th>YW</th>
<th>M</th>
<th>MW</th>
<th>E/P</th>
<th>D</th>
<th>R²</th>
<th>F</th>
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<td>0.667</td>
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<td>1</td>
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<td>(0.08)</td>
<td>(2.14)</td>
<td>(0.85)</td>
<td>(2.45)</td>
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**KOREA**

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<th>M</th>
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<th>D</th>
<th>R²</th>
<th>F</th>
<th>D.W.</th>
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<tbody>
<tr>
<td>0</td>
<td>121.6</td>
<td>-4.38</td>
<td>-0.133</td>
<td>-0.176</td>
<td>1.822</td>
<td>1.765</td>
<td>102.9</td>
<td>0.7</td>
<td>9.89</td>
<td>1.3725</td>
</tr>
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<td>1</td>
<td>(0.85)</td>
<td>(2.39)</td>
<td>(0.28)</td>
<td>(0.42)</td>
<td>(1.52)</td>
<td>(1.85)</td>
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**THAILAND**

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<thead>
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<th>M</th>
<th>MW</th>
<th>E/P</th>
<th>D</th>
<th>R²</th>
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<tbody>
<tr>
<td>0</td>
<td>645.202</td>
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<td>1.417</td>
<td>3.709</td>
<td>-10.986</td>
<td>-0.7548</td>
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<td>0.81</td>
<td>20.15</td>
<td>1.8670</td>
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<tr>
<td>1</td>
<td>(4.250)</td>
<td>(1.25)</td>
<td>(0.75)</td>
<td>(2.98)</td>
<td>(4.12)</td>
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**Note:** $R^2$ is adjusted for degrees of freedom; numbers in parentheses beneath each coefficient are t-statistics; the sign above each variable is the expected sign; the study period for India is 1973Q1-1979Q11 due to lack of data.

This paper presented an alternative way of detecting the existence of the J-Curve for a sample of developing countries. This was done by imposing an Almon lag structure on the exchange-rate variable. For most of the trade balance equations, the empirical evidence given in table 1 appeared to support the pattern of movement described by the J-Curve.

### APPENDIX

**Data Definitions and Sources**

All data are quarterly, measured in domestic currency, and are taken from the following sources:

a. International Monetary Fund, Direction of Trade Statistics, various issues.


d. $TB = \text{index of domestic currency value of (exports - imports), 1975 = 100}$.

$Y = \text{real GNP expressed as an index, 1975 = 100}$. Since quarterly GNP (GDP in some cases) was not available for countries in our sample as well as for some of the trading partners, a quarterly figure was generated using the method described by Bahmani-Oskooee (forthcoming).

e. $YW = \text{"World" real income expressed as an index, 1975 = 100}$. This series was calculated as

$$YW_j = \sum \sigma_i Y_i \quad i = 1, \ldots, 17$$
and
\[ \sum \alpha_{ji} = 1 \]

where \( \alpha_{ji} \) is the weight of market \( i \) in exporter \( J \)'s exports.

\( M = \) level of domestic high power money expressed as an index \( 1975 = 100 \). Following Miles (1979), this series was calculated as the sum of lines 14a and 20 from International Financial Statistics.

\( MW = \) “World” high power money expressed as an index, \( 1975 = 100 \). For each country (\( J \)) in our sample, this series was calculated as
\[ MW_J = \sum \alpha_{ji} M_i \quad i = 1, \ldots, 17 \]

and
\[ \sum \alpha_{ji} = 1 \]

where \( \alpha_{ji} \) is the weight of market \( i \) in exporter \( J \)'s exports.

\( E = \) index of export-weighted effective exchange rate, \( 1975 = 100 \).

\( P = \) index of wholesale prices, \( 1975 = 100 \).

REFERENCES


THE LABOR PRODUCTIVITY SLOWDOWN IN THE UNITED STATES: EVIDENCE FROM PHYSICAL OUTPUT MEASURES

Peter K. Clark and Jane T. Haltmaier*

Abstract—The reduction in labor productivity growth in the United States in the last ten to twenty years is sometimes attributed to the underestimation of real output. This paper presents estimates of labor productivity growth that are based on measures of output that are immune to the output bias that has been hypothesized. These estimates exhibit a reduction in labor productivity growth that is virtually identical to the one observed in official statistics, indicating that the apparent productivity slowdown is unlikely to be a statistical artifact, at least for the industries in the sample.

Possibly since the mid-1960s, and surely since the early 1970s, the growth of labor productivity in the United States has declined substantially. Between 1955 and 1965, real output per hour of labor input in the nonfarm business sector rose at a rate of 2.5% per year. Between 1965 and 1973, this annual growth rate declined to 2.1%, and between 1973 and 1979, it plummeted to 0.7% per year.1 A similar decline was evident in the U.S. manufacturing sector, where the growth rate of output per manhour fell from 3.5% per year between


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