THE PRICING OF MANUFACTURED GOODS DURING TRADE LIBERALIZATION: EVIDENCE FROM CHILE, ISRAEL, AND KOREA

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ABSTRACT

This paper is an investigation of price-setting behavior in Chile, Israel, and Korea when each of these countries moved from a fairly closed to a more open international trade regime. In some cases, the intensification of the opening resulted from real appreciation rather than from a formal adjustment in tariff rates (as in Chile, 1980-82, and Israel, 1983-84). The central thesis of this paper is that the structural price equation for import-competing manufactured goods changes with the degree of openness to trade. When the economy is fairly closed, the main weight is commanded by domestic cost variables and excess demand, and foreign prices only affect pricing through their effects on imported material prices. During trade liberalization the rate of change of prices of an increasing proportion of manufacturing goods begins to be influenced by the landed cost of similar imports, but domestic variables still have a role because selected domestic manufactured goods are considered imperfect substitutes for internationally traded products.

Empirical results from time-varying parameter estimation show that domestic currency prices of imports become progressively more important during the liberalization processes in the three countries, while the effects of domestic costs and excess demand on price-setting behavior become less important, but remain significant.
I. Introduction

A key issue in open-economy stabilization policy is the effect of foreign prices on the pricing decisions of manufacturers. As an economy progressively opens to international trade, do domestic firms adjust their price setting rules and begin to follow the law of one price in their price-setting decisions? Alternatively, do significant proportions of manufacturing goods remain imperfect substitutes for imported goods following a liberalization process, so that domestic costs and demand-pressure variables still matter for price-setting decisions in the manufacturing sector of a small, open economy? If firms quickly adjust their pricing rules with domestic manufacturing prices following closely the prices of internationally-tradable manufactured goods, then the stabilization of the exchange rate is a more effective instrument for reducing inflation in the manufacturing sector. However, if manufacturing prices do not follow closely the landed costs of similar imported goods, then exchange rate stabilization would result in a prolonged period of real appreciation that could make the stabilization effort unsustainable. In this case, aggregate measures for reducing excess demand and wage policy would remain relevant policy instruments in a highly open economy. 1/

This paper is an investigation of the recent experiences of three countries, Chile, Israel, and Korea, which have moved from a fairly closed international trade regime to a more open trade position in a period of a few years. Intermixed with the liberalization policies in each of the three countries were various financial reforms and adjustment programs to specific

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1/ On the relation of exchange rate and prices see Houthakker (1978) and Dornbusch (1987).
external stocks. By the end of their respective liberalization processes, Chile experienced deep recession, Israel a hyperinflation, and Korea a success-story of high growth and low inflation. Given the different outcomes of the liberalization processes in each country, how did manufacturing pricing rules change during the liberalization process? May we expect the exchange rate to become progressively more important (and monotonically larger) and domestic costs and demand variables progressively less important in determining manufacturing prices, as an economy opens up to trade? Alternatively, may the price-setting adjustment process be discrete, either as a result of rapid and discontinuous reductions in trade barriers or due to past presetting of manufacturing prices? What type of indicators of trade policy might show-up in firm price-setting behavior during liberalization?

This paper provides some definite, if preliminary, answers to the above questions through an empirical analysis of manufacturing pricing in Chile, Israel, and Korea during their respective periods of liberalization. The following section presents a theoretical model which is the basis of the empirical analysis. Section III presents the results of the empirical analysis under the assumptions of constant parameters and time-varying parameters. Section IV contains an analysis and interpretation of these results and Section V is the conclusion.

II. The Model

Standard models of pricing of manufacturing can be grouped into two polar cases, one for the closed economy, and the other for the open economy. In the closed economy model, the rate of change of manufacturing prices is a function of the rate of change of unit costs plus a demand pressure variable [Bruno (1978), Corbo (1985b), Gordon (1975)]. In the open economy model
manufacturing goods are taken as tradable, with their rate of change following the law of one price [Aizenman (1986)].

In the recent liberalization attempts in the Southern Cone of Latin America, it was implicitly and sometimes explicitly assumed by the economic authorities, that the rate of change in domestic prices of manufacturing goods was going to follow closely the law of one price. 1/

The central thesis of this paper is that the structural equation of manufacturing prices changes with the degree of openness. In particular, when the economy is fairly closed, the main weight is commanded by the domestic cost variables and foreign prices only affect pricing through their effects on imported material prices. When tariff and non-tariff barriers are being reduced, an increasing proportion of manufactured goods become tradables and therefore aggregate manufacturing prices starts to follow the law of one price. However, even when all restrictions to trade are lifted domestic cost factors still could affect manufacturing prices through two channels: first, through the transportation and distribution margins which are usually non-traded services and are included in the wholesale price of manufactures, and secondly, because manufactured goods could be considered as differentiated tradables by consumers. These are commodities that do not have a perfect imported substitute and commodities whose distribution and repair services are important factors in the purchasing decision.

We begin with the two polar models and then derive the overall price equation for manufactured goods.

1/ In some cases it was even assumed that the whole CPI index was going to follow the law of one price.
For expository purposes, if all manufactured goods are homogenous tradables, and if there are no quantitative restrictions to trade and no water in the tariff, then domestic prices of manufactured commodities follow the law of one price \[ \hat{P}_{Mt} = \hat{P}_{E_t} \] (1)

where \( \hat{P}_{Mt} \) represents the rate of change in manufactured goods prices under free trade and \( \hat{P}_{E} \) is the rate of change of external prices of manufactured goods in domestic currency.

In contrast, if the economy is closed to trade in manufactured goods then manufactured prices will be governed by a mark-up equation (Corbo (1985b), Bruno (1979), Gordon (1975)),

\[ \hat{P}_{Mt} = a_0 + a_1 \hat{ULC}_t + a_2 \hat{UMC}_t + a_3 \hat{ED}_t \] (2)

where \( \hat{P}_{Mt} \) represents the rate of change in the price of manufactured goods in a closed economy, \( \hat{ULC} \) is the rate of change in unit labor costs (defined as the rate of change of wages less productivity growth), \( \hat{UMC} \) is the rate of change in unit prices of imported materials, and \( \hat{ED} \) is the excess demand variable.

For a semi-open economy, we assume

\[ \hat{P}_{Mt} = \delta \hat{P}_{Mt} + (1 - \delta) \hat{P}_{Mt} \] (3)
The symbol $\delta$ represents a variable that is a monotonic increasing function of the degree of openness to trade. We assume $0 < \delta < 1$.

Replacing (1) and (2) in (3) we obtain the final price equation for a semi-open economy:

$$\hat{P}_{Mt} = \delta \hat{PE}_t + (1-\delta) [\alpha_0 + \alpha_1 \hat{ULC}_t + \alpha_2 \hat{UMC}_t + \alpha_3 \hat{ED}_t]$$

If we assume further that 1/

$$\hat{UMC}_t = \hat{PE}_t$$

we obtain,

$$\hat{PM}_t = (1-\delta)\alpha_0 + [\delta+(1-\delta)\alpha_2]\hat{PE}_t$$

$$+ (1-\delta)\alpha_1 \hat{ULC}_t + (1-\delta)\alpha_3 \hat{ED}$$

This is the final model we estimate. Although the individual coefficients are not identified, the effect of the right hand side variables on $\hat{PM}_t$ can be estimated from the following equation:

$$\hat{P}_{Mt} = \beta_0 + \beta_1 \hat{PE}_t + \beta_2 \hat{ULC}_t + \beta_3 \hat{ED}_t$$

where

1/ Although it would be better not to make this assumption, the high collinearity of imported raw material prices and external prices of manufacturing goods made this assumption necessary.
\[ \beta_0 = (1-\delta)\alpha_0; \quad \beta_1 = \delta + (1-\delta)\alpha_2 \]
\[ \beta_2 = (1-\delta)\alpha_1; \quad \beta_3 = (1-\delta)\alpha_3 \]
\[ \beta_1 + \beta_2 = \delta + (1-\delta) [\alpha_1 + \alpha_2] \leq 1.0 \]

In the semi-open economy model of equation (5) \( \beta_1 \) is a monotonic increasing function of \( \delta \), and \( \beta_2 \) and \( \beta_3 \) are monotonic decreasing functions of \( \delta \).

If liberalization processes occurred during the sample period of the estimation, then the coefficients will be changing with the degree of openness as \( \beta_0, \beta_1, \beta_2 \) and \( \beta_3 \) are expected to change systematically with changes in openness. The estimation of equation (5) requires the use of an estimation technique with variable coefficients.

III. Data and Empirical Results

This section contains the estimation results of the model presented in the preceding section. To avoid problems of data mining we use the same equation across the three countries. Thus we abstain from searching for the specification that, for a given sample, would provide the best overall fit and the most significant coefficients. For the sake of comparison with the time-varying parameter estimates, we first discuss the results of the model estimated with ordinary least squares (OLS) under the assumption of time-invariant parameters. Then we discuss the results estimated by Kalman Filtering under the assumption of time-varying parameters.

Data for Chile are described in Corbo (1985b) and for Korea in Corbo and Nam (1986a). For Israel, time series from the IMF International Financial Statistics were used, since data on effective exchange rates were not
available after 1977, we had to use dollar exchange rates for the post 1977 period. For this reason, the results on Israel may be less reliable.

The rate of change of unit labor costs in each series is defined as the rate of change of wages less the rate of productivity growth, the latter is defined as the four quarter moving average of the rate of change of output per worker in the manufacturing sector in each country.

The rate of change of external costs is defined as the rate of change of the external prices (including tariffs) in local currency; this variable thus includes the effects of changes in world prices, exchange rates and tariff policy. Although it would be preferable to calculate the rate of change of unit costs of imported materials as the rate of change of imported material prices less the productivity growth rate of imported materials, the lack of data on the productivity of imported inputs forced us to define this variable simply as the rate of change of external prices. 1/ Similarly, the high collinearity of international prices of manufactured goods and imported material prices (in terms of local currency) forced us to define the rate of change of imported material prices as equal to the rate of change of externally-produced manufactured goods prices, thus precluding identification of the coefficients in the model.

The excess demand variable in the pricing equation is measured for Korea as the rate of change of new orders less the rate of change of inventories in the manufacturing sector. For Chile and Israel our excess demand variable is less accurate: it is the rate of growth of the money supply less the rate of growth of real output.

1/ Most probably the rate of change of productivity growth of imported materials is fairly constant and thus is included in the constant of the regression.
The estimation period for all three countries starts in the early 1970's and ends in the mid-1980's. The reason for choosing these bounds is based on availability of data, on the fact that in earlier periods many prices and wages were controlled, and because the liberalization period began in the mid to late 70's. Choosing an earlier bound would thus reduce the effect of the liberalization process on the overall evolution of the coefficients. 1/

A. OLS Results: Constant Coefficient Assumption

The results of ordinary least squares estimation of the pricing equation for Chile, Israel, and Korea appear in Table I.

The results show that for all three countries, the coefficients of external costs and wages add-up to a value less than unity. This is consistent with the restrictions imposed by the model. The coefficients of the external cost and wage variables are significant for all three countries as well. The results give slightly more weight to external costs over domestic labor costs in the determination of inflation in manufactured goods in Chile. The opposite holds true for Israel. For Korea the weights are about equal.

B. Time-Varying Parameter Estimates

Time-varying parameter estimation with the Kalman Filter has been described by McNelis and Neftci (1982), in a comparative analysis of the stability of the Fair and Sargent supply-side equations. Estimation proceeds in three steps: (1) specification of starting values for the coefficients and

1/ In Chile we began the estimation at 1975. Price controls were abandoned in 1973, but major barriers to trade, in the form of tariffs and non-tariffs were well in existence up to 1975.
Table 1:

OLS Estimates of Manufacturing Price Adjustment Equations

<table>
<thead>
<tr>
<th>Country</th>
<th>$\beta_0$</th>
<th>$\beta_1$</th>
<th>$\beta_2$</th>
<th>$\beta_3$</th>
<th>$R^2$</th>
<th>DW</th>
<th>$\sigma$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chile</td>
<td>-.305</td>
<td>.582</td>
<td>.349</td>
<td>.016</td>
<td>.913</td>
<td>1.78</td>
<td>4.46</td>
</tr>
<tr>
<td>75.1-85.2</td>
<td>(.29)</td>
<td>(10.7)</td>
<td>(3.36)</td>
<td>(0.198)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Israel</td>
<td>.001</td>
<td>.322</td>
<td>.634</td>
<td>.051</td>
<td>.89</td>
<td>2.03</td>
<td>4.99</td>
</tr>
<tr>
<td>70.1-85.2</td>
<td>(.0001)</td>
<td>(4.94)</td>
<td>(8.15)</td>
<td>(0.98)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Korea</td>
<td>-.050</td>
<td>.48</td>
<td>.49</td>
<td>.046</td>
<td>.52</td>
<td>1.60*</td>
<td>3.52</td>
</tr>
<tr>
<td>72.1-84.4</td>
<td>(1.44)</td>
<td>(7.01)</td>
<td>(2.45)</td>
<td>(1.49)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Symbols:**

$\beta_0$ - constant term

$\beta_1$ - coefficient of external price changes

$\beta_2$ - coefficient of unit labor cost changes

$\beta_3$ - coefficient of excess demand variable

$R^2$ - multiple determination coefficient

$DW$ - Durbin-Watson statistics

$\sigma$ - standard error of regression

* - DW statistic is in the indeterminate range

**Note:** For Korea, the unit labor cost coefficient is estimated with a polynomial distributed lag, second degree, with head and tail constraints. The weights are set at values of .07, .20, .31, and .40 for observations from (t-1) to (t-4) respectively.
the variance-covariance matrix at time $t = 0$; (2) *a priori* specification or maximum-likelihood estimation of a stochastic process for the time-varying coefficients and the variances of the innovations, and (3) an iterative solution to find the best one-period predictor of the dependent variable at each period. Intuitively, the Kalman Filter may be described as an "optimal discounting" of past data to find the best one-period forward predictors. Rolling regressions, on the other hand, give equal weight to past and present data in giving the one-period forecasts. [See Wall (1980) for a guide to program use; see Pagan (1980) for a further elaboration of time-varying estimation techniques.]

The distribution of the Kalman-Filter estimates is not known, and tests of the variability of coefficients have been biased [See, for example, Chow (1984)]. In order to assess the significance of the variability of the coefficients, we show in each graph, in addition to the time-varying coefficient estimates, the ols estimate (under the null hypothesis of constant parameters), and upper and lower bounds for the ols estimate (calculated at 90% confidence intervals, based on the estimated standard error and the critical $t$-statistic). If the Kalman-Filter estimate at any time $t^*$ is outside the upper or lower bounds, then the variation is significantly different from the variation one may tolerate under the constant coefficient assumption. In this case, one may reject the hypothesis of constant parameters during the period of the liberalization process.

**Chile**

The results of the time-varying parameter estimation of the Chilean data appear in Figures I and II. Figure I shows the variation of the
Figure I

Chile: OLS and Time-Varying External Price Coefficient
Figure II

Chile: OLS and Time-Varying Labor Cost Coefficient
coefficient of external price, while Figure II shows the variation for the unit labor cost coefficient.

Figure I shows that the external price coefficient is significantly greater than the ols coefficient between 1975 and 1980, and significantly lower after 1982. Figure II shows that the unit labor cost coefficient declines between 1975 and 1980, but the change is not significant. It rises after 1980, and is significantly higher than the ols coefficient after 1982. These dates for the changes in the coefficient variation are striking. As discussed below, the 1975-79 and post 1982 periods marked two contrasting periods of opening-up and closing of the Chilean economy.

Israel

The time-varying estimation of the external price and wage coefficients for the Israeli data appear in Figures III and IV. Until 1977, the external price coefficient is significantly below the ols estimate, and after 1980 it is marginally higher than the upper bound for the ols estimate. The unit labor cost coefficient, on the other hand, is significantly below the ols coefficient only time in the early 1970's. Since the period of the late 1970's was a period of opening-up of the Israeli economy, the behavior of the external price coefficient, as discussed below, is consistent with the assumptions of the model. The high value of the coefficient in the 1980's is consistent with the increasing inflation. In this case, the exchange rate may have become the main indicator of inflationary changes, and thus would have a higher weight in pricing decisions.
Figure III

Israel: OLS and Time-Varying External Price Coefficient
Figure IV

Israel: OLS and Time-Varying Labor Cost Coefficient
Korea

The time variation of the coefficients of external price and unit labor costs for the Korean data appear in Figures V and VI. These figures show sharp breaks in the series in 1974. From 1976 through 1979 the external cost coefficient remains significantly below the ols estimate, but then it rises. The unit labor costs coefficient varies somewhat after 1976, but the variation is within the bounds of the ols estimates.

C. Tests for Randomness

Two issues arise about the variability of the coefficients: first, are the coefficients simply random deviations around a constant mean (such as the ols estimates), and secondly, if they are not random deviations around a constant mean, does their behavior indicate a systematic movement related to the trade liberalization process?

The results of Figure I - VI indicate that the Chilean external price and unit labor cost coefficients, and the Israeli and Korean external price coefficients show significant variation.

To determine if the variation is related to the liberalization policies during the periods of estimation, indices of liberalization were obtained from Papageorgiou, Michaely, and Choksi (1986). While these indices are not meant for cross-country comparisons of liberalization "success", they are useful for gauging changes in the openness of each country over time. For our purpose, these indices serve as measures of the exogenous policy changes which may cause the coefficients to change over time.

The indices for Israel are available only up to 1980. In order to extend the data, we "updated" the series through a regression of these indices
**Figure V**

Korea: OLS and Time-Varying External Price Coefficient
Figure VI

Korea: OLS and Time-Varying Labor Cost Coefficient
on the ratio of imports plus exports to Israeli gdp, and then computed a forecast of the liberalization indices for the rest of the sample period.

Table II gives the results of simple regressions of the significant time-varying parameter estimates on their lagged values and the lagged values of the indices of liberalization for each country. The coefficients are significant in four cases, with the expected signs for the Israeli and Korean external price coefficients. However, the signs are opposite of what we expect for Chile: liberalization has a positive effect on the unit labor cost coefficient and a negative effect on the external price coefficient. The effect of the liberalization variable on the Israeli unit labor cost coefficient is insignificant.

The opposite of the expected signs of the liberalization effects on the Chilean time-varying parameters may be due to preannouncing of the liberalization and exchange rate policies in Chile during this period. With preannouncing, the future or lead values of the liberalization indices may have more of an effect on the current value of the price-equation parameters than current or past values, since the future values are known at the current time. Table III gives the results of regressions of the time-varying parameters on lead, current, and lagged values of the liberalization indices. The two-period lead effect of the Chilean liberalization index on the external price coefficient is significant and of the expected sign. The one-period lead and current effects are also significant and opposite in sign; while the other terms are insignificant. The total effect is of the expected sign, for the significant coefficients. For the Chilean unit labor cost the same pattern holds. For the Israeli and Korean external cost parameters, the regressions generate the expected signs, except for two variables, the current-period index for Israel and the two-period lead for Korea. However,
### Table II

**Time-Varying Parameters and Liberalization Indices**

<table>
<thead>
<tr>
<th>Country</th>
<th>$\gamma$</th>
<th>$\beta(-1)$</th>
<th>$\theta(-1)$</th>
<th>$R^2$</th>
<th>DW</th>
<th>$\sigma$</th>
<th>$Q$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chile 1975.2-85.2</td>
<td>$\beta_{ext}$</td>
<td>.944</td>
<td>-.005</td>
<td>.89</td>
<td>1.90</td>
<td>.059</td>
<td>6.20</td>
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<tr>
<td></td>
<td></td>
<td>(17.95)</td>
<td>(1.74)</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>$\beta_{ulc}$</td>
<td>.97</td>
<td>.005</td>
<td>.94</td>
<td>1.94</td>
<td>.038</td>
<td>8.74</td>
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<td></td>
<td></td>
<td>(25.24)</td>
<td>(2.52)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Israel 1970.2-85.2</td>
<td>$\beta_{ext}$</td>
<td>.839</td>
<td>.0116</td>
<td>.949</td>
<td>2.04</td>
<td>.044</td>
<td>4.34</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(14.10)</td>
<td>(2.61)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>$\beta_{ulc}$</td>
<td>.85</td>
<td>.0031</td>
<td>.85</td>
<td>1.59</td>
<td>.032</td>
<td>9.88</td>
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<td></td>
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<td>(12.7)</td>
<td>(1.46)</td>
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</tr>
<tr>
<td>Korea 1972.2-84.4</td>
<td>$\beta_{ext}$</td>
<td>.469</td>
<td>.025</td>
<td>.71</td>
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<td>(2.19)</td>
<td>(3.36)</td>
<td></td>
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</table>

**Symbols:**
- $\gamma$ - dependent variable in the regression
- $\beta_{ext}$ - coefficient of external cost changes
- $\beta_{ulc}$ - coefficient of unit labor cost changes
- $\theta(-1)$ - lagged time-varying coefficient
- $\theta(-1)$ - lagged index of liberalization
- $R^2$ - multiple determination coefficient
- DW - Durbin-Watson statistic
- $\sigma$ - standard error of regression
- $Q$ - Box-Pierce statistic for serial independent residuals (10 autocorrelations)
Table III:

Lead and Lag Effects of Liberalization on Parameters

<table>
<thead>
<tr>
<th>Independent Variable</th>
<th>Chile $\beta_{ext}$</th>
<th>Chile $\beta_{ulc}$</th>
<th>Israel $\beta_{ext}$</th>
<th>Israel $\beta_{ulc}$</th>
<th>Korea $\beta_{ext}$</th>
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<tr>
<td>$\theta(-1)$</td>
<td>.915</td>
<td>.898</td>
<td>.839</td>
<td>.855</td>
<td>.428</td>
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<td></td>
<td>(13.77)</td>
<td>(17.35)</td>
<td>(12.9)</td>
<td>(12.28)</td>
<td>(3.08)</td>
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<tr>
<td>$\theta(+2)$</td>
<td>.126</td>
<td>-.078</td>
<td>-.013</td>
<td>.00002</td>
<td>-.081</td>
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<tr>
<td></td>
<td>(3.61)</td>
<td>(3.59)</td>
<td>(.858)</td>
<td>(.002)</td>
<td>(.478)</td>
</tr>
<tr>
<td>$\theta(+1)$</td>
<td>-.235</td>
<td>.131</td>
<td>.017</td>
<td>.007</td>
<td>.242</td>
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<td></td>
<td>(3.22)</td>
<td>(2.90)</td>
<td>(.849)</td>
<td>(.475)</td>
<td>(.521)</td>
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<tr>
<td>$\theta(0)$</td>
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<td>-.081</td>
<td>.006</td>
<td>.004</td>
<td>-.249</td>
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<td></td>
<td>(1.91)</td>
<td>(1.81)</td>
<td>(.323)</td>
<td>(.279)</td>
<td>(.519)</td>
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<td>$\theta(-1)$</td>
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<td>.030</td>
<td>.0007</td>
<td>-.007</td>
<td>.119</td>
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<td>(.891)</td>
<td>(1.37)</td>
<td>(.045)</td>
<td>(.666)</td>
<td>(.630)</td>
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<tr>
<td>$R^2$</td>
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<td>.96</td>
<td>.947</td>
<td>.861</td>
<td>.711</td>
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<td>.05</td>
<td>.03</td>
<td>.04</td>
<td>.033</td>
<td>.04</td>
</tr>
<tr>
<td>$DW$</td>
<td>1.56</td>
<td>1.94</td>
<td>2.03</td>
<td>1.64</td>
<td>2.12</td>
</tr>
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</table>

Symbols:  
- $\beta_{ext}$ - coefficient of external costs  
- $\beta_{ulc}$ - coefficient of unit labor costs  
- $\theta$ - index of liberalization  
- $R^2$ - multiple determination coefficient  
- $\sigma$ - standard error of regression  
- $DW$ - Durbin-Watson statistic

Note: regression bounds correspond to Table II. T-statistics are in parentheses.
without the lead terms, the effects of the liberalization policies are significant and of the expected sign. Finally, for the Israeli unit labor cost coefficient, the lag terms are of the expected signs, but insignificant, while the lead terms are positive and insignificant, indicating that the labor cost parameter does not respond to changes in the degree of openness of the economy.

IV. Interpretation of the Results

In this section, we interpret the results of the previous section by linking the time profile of the coefficients with the policy changes that were taking place. We begin with the case of Chile.

A. Chile 1/

In 1973 the trade regime of Chile was one of the most closed among developing countries. Average nominal tariffs were over 90 percent, and imports were also subject to a large number of non-tariff barriers as well as import deposits. A multiple exchange rate system contemplated a ratio of 50 to 1 between the largest and the smallest exchange rate. By late 1973 most non-tariff barriers started to be lifted. Although some tariff reductions took place, by 1975 tariffs were on the average about 70 percent. In mid-1975 a progressive trade liberalization process aimed at reducing tariffs and tariff dispersion was implemented. This process culminated in June 1979 when all tariffs but one (for motor vehicles over 850 cc) were set at 10 percent of the CIF value. By this time all other non-tariff barriers to trade were

1/ There are many interpretations of the Chilean liberalization experience. See, in particular, Corbo (1985a, 1987), Edwards (1985) and Harberger (1985).
completely lifted. Thus, in seven years, Chile changed from one of the most closed economies among developing countries to one of the most open.

As the economy was becoming more open to trade a view developed in Chile that the evolution of domestic prices should follow international prices. The model presented in Section II assumes that the price of manufactured goods even in the open economy would be dependent on unit labor costs and excess demand.

Parallel to the opening up of the economy, Chile was trying to control a stubborn inflation that had reached an annual rate close to 1,000 percent in late 1973. This inflation was reduced to 50 percent by late 1977 and 30 percent by late 1978.

In terms of the time-varying coefficient model one expects that the coefficient of external prices should increase monotonically with a monotonic increase in the degree of openness of the commercial account. For the coefficient of unit labor costs the reverse is expected.

The time profile of the coefficient of external prices appears in Figure I. From the figure we observe that the coefficient increases gradually up to the first quarter of 1980 and then begins to drop, first gradually, and then rapidly, until 1982. This is the period when tariff rates are only 10 percent, and the exchange rate is at a peak of a real appreciation period that had started in 1980 [Corbo (1985a)]. In the second quarter of 1982 there was a large real depreciation that for all practical purposes transformed many manufacturing goods into non-tradables. This coincides with a drop in the coefficient of external prices, which remained low up to the third quarter of 1984 when it began to rise again. By now, part of the real devaluation had been lost through inflation but still a 30 to 35 percent real devaluation was
left. The coefficient of wages is almost the complement of the coefficient of external prices. The evolution of the wage coefficient appears in Figure II.

B. Israel 1/

The next two figures show the time profile of the external cost and unit labor cost variables for the Israeli economy.

The external price coefficient stays significantly below the ols estimate until 1977, when foreign exchange liberalization began. We observe an increase in the external cost coefficient until 1980, when the liberalization process continued with the reduction of tariffs and subsidies, and the spread of dollar-linked assets. Then the coefficient leveled off. At this time, the policies of Finance Minister Hurwicz sharply cut the current account deficit by reducing the amount of imports, and the real exchange rate stabilized [Bruno and Fischer (1986), p. 363].

Aridor became Finance Minister in 1981. Bruno and Fischer point out that in this period "subsidies were incurred, import tariffs slacked and the exchange rate appreciated, which led to an 80 percent increase in consumer durable imports" [Bruno and Fischer (1986), p. 365]. It is not surprising that the external price coefficient remains high and significantly above the ols estimate during this period. In 1982, Aridor introduced still another policy: he hoped to move the economy to an inflation rate of 5 percent per month "by keeping the rate of increase of the exchange rate and controlled prices to that rate" [Bruno and Fischer (1986), p. 365]. However, monetary policy was not consistent since "nominal magnitudes were expanding to levels

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1/ For a discussion of recent trade and macroeconomic policy in Israel, see Bruno and Fischer (1986), Fischer (1984) and Liviatan and Pitterman (1986).
well above 100 percent per year", which implied a "rapid real exchange rate appreciation, and an increasing current account deficit" [Bruno and Fischer (1986), p. 365]. This appreciation is consistent with the persistent relatively high value of the external cost coefficient after 1982.

The coefficient of unit labor costs follows a mirror image of the external cost coefficient after liberalization began. As the economy became more open through financial liberalization in the late 1970s, it fell significantly below its ols value. However, during the Hurwicz import cutting policies in early 1978 this coefficient increased slightly and during the Aridor period, the coefficient remained fairly constant. The insignificant effect of the liberalization index on the unit labor cost coefficient, reported in Tables II and III, may be due to the increasing importance of negotiations of the Central Union (the Hidrastut) in setting the degree of wage indexation in progressively shorter adjustment intervals. The progressively more important role of indexation and central union activity may overshadow the effects of liberalization on the relative size of the unit labor cost coefficient.

C. **Korea 1/**

The estimated coefficients for Korea appear in Figures V and VI.

In the case of Korea, inflation was hovering around 13 percent per year in the period 1960-1972. Then, inflation accelerated following the first oil shock, slowing down up to 1977. It then started accelerating again following both domestic expansionary policies, large increases in unit labor

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1/ For a discussion of experiences of trade liberalization and stabilization in South Korea, see Corbo and Nam (1986a, 1986b), S. W. Nam (1984) and C. H. Nam (1986).
costs, and the second oil shock. By 1980 inflation had accelerated to 40 percent per year. In 1980 Korea started to implement a quite successful stabilization program that resulted in single digit inflation by 1982 and only 2 percent inflation in 1984.

Partial measures to control inflation were taken in 1977 and in 1978. In the Spring of 1978 further stabilization actions were implemented in the form of fiscal deficit reduction and control of the expansion of credit. Import liberalization was also used as a stabilization device.

The stabilization programs of April 1979 came amidst a general consensus in South Korea that stabilization was a precondition to resuming growth. The program was more comprehensive than just moderate fiscal and monetary policy; it included some trade liberalization in manufacturing commodities and special attention to the supply of daily necessities [Corbo and Nam (1986a)]. Trade liberalization included the lifting of quantitative restrictions (QR's) and the reduction in ad valorem tariffs. The government had already attempted to lift QR's in 1978 but the second oil shock stopped this liberalization attempt. After this, trade liberalization was not attempted again until 1983, when an import liberalization plan was announced. This plan called for an increase in the share of import categories free of QR's from 80.3 percent in 1983 to 91.6 percent in 1986 and 15.2 percent in 1988. The plan also included a tariff reform schedule to be completed by 1988. Tariff adjustments are taking place which reduce the 1983 tariff range of 0 to 100 percent to a range of 0 to 30 percent in a series of small steps. Together with the implementation of these stabilization and trade liberalization policies, Korea implemented a set of reforms aimed at increasing domestic competition through anti-trust legislation.
The evolution of the time-varying coefficients in the manufacturing price equations reflect these policy changes quite closely. Starting with some fluctuations (after the lifting of price controls) in the early seventies, the coefficient of external prices in Figure V stabilized around 0.30 in early 1975 and remained close to that value until late 1979. It then gradually increases to value of 0.49 and stabilizes there.

The coefficient of wage cost in Figure VI does not reflect the same pattern. It remains low relative to the ols value after the liberalization process began in 1979, and stays fairly constant.

V. Conclusion

The results of this paper show that the coefficients of external prices and unit labor costs can change systematically with the degree of openness of the economy, with the exchange rate becoming more important and the domestic variables less important as liberalization progresses. The results also imply that it is not sufficient for policy makers to rely on a quick transition to complete substitutability of domestic and foreign manufactured goods and to adopt a law of one price policy. Domestic wage effects may still be important and direct channels for stabilizing inflation even following periods of liberalization.

Our analysis does not take into account the effects of exchange rate changes on expectations, nor are interest rate effects incorporated into the price-setting decisions of firms. A more complex model explicitly treating interet rate liberalization, exchange rate expectatons, and capital flows in addition to the trade liberalization process would provide more detail and a more accurate measure of the price-setting coefficients during the sample periods of this study.
References


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