ECONOMETRIC EVIDENCE ON LDC EXPORTS: A CONTRIBUTION TO THE HONG KONG DEBATE

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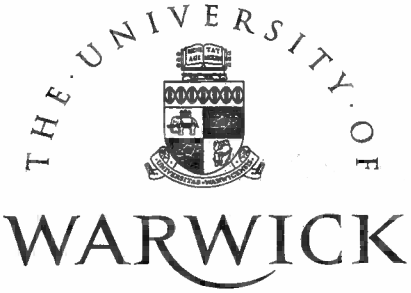

DEPARTMENT OF ECONOMICS

ECONOMETRIC EVIDENCE ON LDC EXPORTS: A CONTRIBUTION TO THE HONG KONG DEBATE

Dennis Leech and Gareth Halstead
Department of Economics
University of Warwick
Coventry CV4 7AL
England

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Department of Economics
University of Warwick
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CV4 7AL

Abstract: This paper argues that previous empirical work on the explanation for Hong Kong's export growth, by focusing on the values of the estimated price and income elasticities, has failed to provide a full account. It is necessary also to look at changes in the explanatory variables in the model, both their signs and their magnitudes: a large change in a variable with a small elasticity may explain more than a small change in one with a large elasticity. It also shows that a previous test of the hypothesis that Hong Kong is a "small country" whose exports are independent of world income lack power. It supports the conclusion that Hong Kong's export growth can be better explained by growth in income in export markets than by price reductions.

Acknowledgement. We would like to thank Professor James Riedel for kindly supplying us with his data.

There has been considerable debate in recent years in the Economic Journal concerning the factors underlying the growth in exports from NIE's with special reference to Hong Kong (Riedel(1988), Nguyen(1989), Riedel(1989), Muscatelli, Srinivasan and Vines(1992), Athukorala and Riedel(1994), Muscatelli(1994)). In his original contribution, James Riedel (1988) challenged the traditional view, based on findings of low price elasticities and high income elasticities of demand, that the most important factor has been growth of demand in the developed countries which form the principal export markets. He provided econometric evidence which seemed to reverse this conclusion. That study attracted comments which criticised the econometrics on various grounds. The latest interchange was in November 1994 but the question still appears not to have been finally resolved. In this paper we seek to contribute to the debate and suggest that Professor Riedel's evidence has not been conclusive.

Riedel (1988) argued that the conventional approach to modelling exports (for example Goldstein and Khan (1982)) ignored the supply side and concentrated exclusively on the export demand function, essentially assuming an infinite supply elasticity. Instead, he maintained that a small economy exporting manufactures should be modelled like a firm in a competitive market facing an infinitely elastic demand function at an exogenously determined price. Using data for the period 1972 to 1984 he tested this assumption and found it consistent with the data. He therefore argued that the volume of exports is determined by the supply-side factors of wage rates, raw materials prices and productivity rather than the traditionally assumed demand factor of world income. Muscatelli Srinivasan and Vines (MSV) (1992) re-

estimated the model using the same data and found contrary results which are consistent with the traditional view. Athukorala and Riedel (1994) also re-estimated using the same data and got opposite results supporting the supply-side explanation.

1. In this paper we seek to contribute to the debate in two ways. First, as a general methodological point, we suggest that previous analyses have employed an overly narrow idea of econometric explanation in looking only at the signs, magnitudes and statistical significance of estimated coefficients. The issue at stake is not the values of the coefficients of the demand function - in the sense of whether the price elasticity is bigger than the income elasticity - but providing an account of the factors which have led to the growth in the dependent variable, export volume. It is necessary therefore to take account of the changes which have taken place in the relevant explanatory variables associated with those coefficients. Second, we argue that Riedel's finding of strong support for the "small country" hypothesis is the result of testing an inappropriate restriction which makes the test employed have low power.[1]

I. MODELLING HONG KONG'S EXPORTS

The traditional approach to modelling exports from LDCs uses a straightforward demand function in which the dependent variable is a quantity index and the explanatory variables are a price index, an index of the price of competing goods and real income in export markets. The static or long-run version (variables in logs) is:

$$Q = a_0 + a_1P + a_2PW + a_3YW \qquad (1)$$

where Q is exports, P the price of exports, PW the (domestic currency) price of competing goods (world price) and YW a measure of economic

activity in export markets (world income); $a_1<0$, $a_2>0$, $a_3>0$. Supply is assumed to be perfectly elastic so the explanation of the growth in exports is entirely in terms of demand factors.

Most empirical work within this framework has used a dynamic version of this specification to allow for adjustment lags, and a single equation estimator, and the general result has been to find relatively low price elasticities and high income elasticities. The implication drawn from this has been that LDC exports depend to a great extent on the level of income in export markets in developed countries and that there is little scope for policy based on improving price competitiveness.

Riedel (1988) emphasised the importance of modelling the supply function as well as the demand function and argued for a simultaneous model in which both price and quantity are endogenous. It is possible to do this for Hong Kong because its manufacturing sector is almost completely specialised to exporting and therefore there is no difficulty in specifying an appropriate supply function.. His supply function specification is based on the idea of a firm with a neoclassical production function maximising profits given prices of output, materials and labour. The function he estimated in his original paper, in its static or long-run version, is:

$$Q = b_0 + b_1 P_t + b_2 PM_t + b_3 W_t + b_4 Z \qquad (2)$$

where PM is an index of material input prices, W an index of nominal wages in manufacturing, Z stands for a measure of capacity growth and productivity change (proxied by a linear trend term). The actual estimating equation used assumed a one-quarter lag between production and export and a lagged dependent variable for partial adjustment. Riedel's model has a third equation, to explain wages W, but our

concern centres on the first two equations and little is gained for our purposes by not treating W as exogenous.

Riedel argued that the Hong Kong manufacturing sector in the world economy should in fact be modelled like a firm operating in competitive product and factor markets. The demand curve is expected to be perfectly elastic rather than in the form of equation (1). The growth of exports is thus determined by changes in the supply-side variables. In accordance with his wish to be able to test this "small country" assumption he chose to work with the inverse demand function,

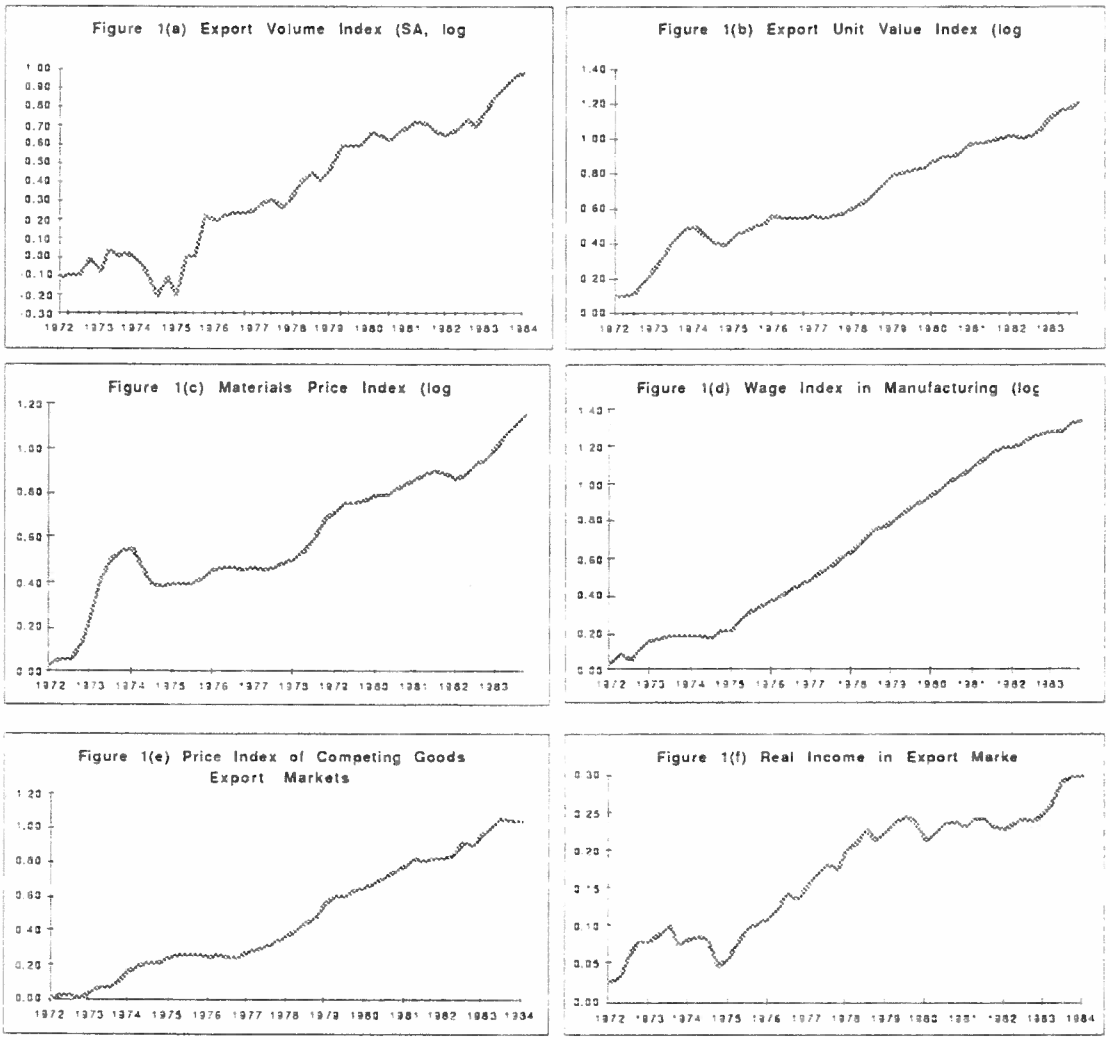
$$P = c_0 + c_1 Q + c_2 PW + c_3 YW \qquad (3).$$

Equation (3) is used rather than equation (1) since it allows this hypothesis to be tested as a simple parameter restriction.

Riedel estimated this model using quarterly data over the relatively short twelve year period 1972 to 1984, 49 observations, plotted in Figure 1. He followed the conventional approach of assuming a partial adjustment mechanism in each equation, ignoring the time-series properties of the variables. He obtained estimates of the (long-run) parameters of equations (2) and (3) and also the dynamic adjustment parameters. The latter he used to calculate the mean lags of the partial adjustment processes in each of the structural equations separately. Ignoring the interaction of simultaneity and dynamics in this way leads to an upward bias in the estimates of the mean lags in the responses of exports and export prices to changes in the exogenous variables. We do not pursue the question of the short run dynamics in this paper, however, taking the view that the focus of the debate is on the underlying long run parameters rather than forecasting and that

with such a small sample it is not possible to obtain good estimates of these parameters. This approach assumes that adjustment lags are sufficiently short to allow long-run effects to occur in the data period.

Figure 1: The Data (all variables in logs)

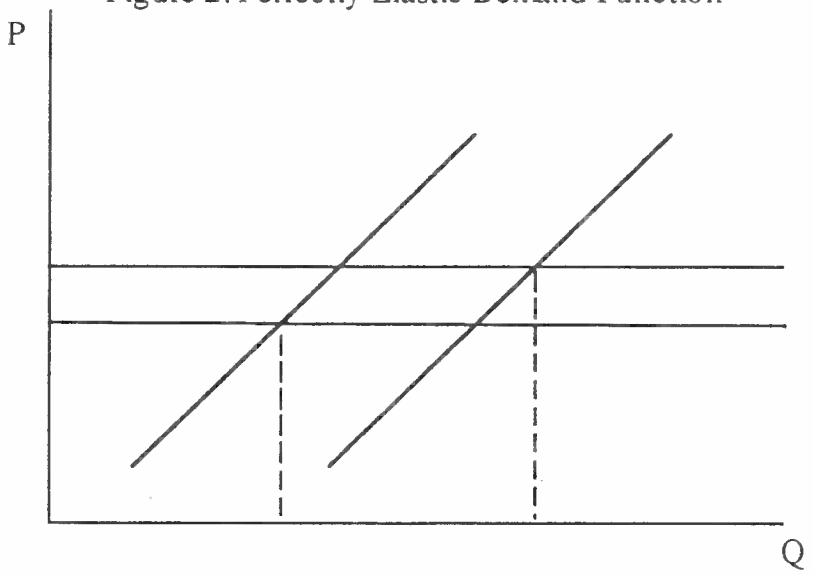


Riedel (1988) estimated the model by two stage least squares ignoring the fact that all the series are non-stationary: MSV(1992) showed that they are all I(1). Our principal concern here is not with the details of the estimation procedure - MSV provided better estimates - but with the interpretation of the results. We therefore discuss the

results as they stand using the long-run coefficients. In calculating the long run parameters we have assumed a variable in the supply function, Z, representing capacity and productivity changes, which is proxied by a linear trend. We have treated this variable in the same way as the others, rather than regarding it simply as a trend.

In Riedel's estimated inverse demand function, based on equation (3), the coefficients of both quantity, Q, and income, YW, were found to be insignificantly different from zero. Riedel therefore accepted that demand is perfectly price elastic and perfectly income inelastic and that the explanation of the growth in exports lay with the supply function. His estimated supply function had significant coefficients on input prices, PM and W, output price P, and capacity/productivity, Z. The situation is therefore as depicted in Figure 2 showing an output price rise and a supply shift to the right.

Figure 2: Perfectly Elastic Demand Function



II. ECONOMETRIC EXPLANATION: ELASTICITIES ARE NOT ENOUGH

The supply-side explanation of the growth of exports is not only in terms of the values of the elasticities but it also makes an implicit assumption that movements in the causal explanatory variables have been such as to have contributed to the observed growth. Thus we would expect to have observed input price reductions and productivity improvements over the period, moving the supply function in Figure 2 to the right. Exogenous changes in export prices will induce movements along the supply function. Estimated parameters should permit us to analyse changes in exports into these various components.

Table 1 shows Riedel's long-run parameter estimates for the supply function and an analysis of their implications in an explanation of export growth. The coefficients were constrained to satisfy long run homogeneity of degree zero in prices and the price variables in the table are expressed as relative prices. The numeraire used is the world price index, PW, chosen because the key variable in this explanation is export prices relative to this, P-PW. We have also repeated the analysis using the domestic consumer price index, PC, and found similar results.

Figure 3 gives an overview of these changes. Figure 3(a) shows a very strong increase in export volume over the period as a whole with a major downturn in the mid 1970s. The price series in Figure 3(b) does not show an unambiguous picture: prices have tended to increase rather than decrease over the sample period as a whole, though after 1976 there is a general downward trend. Figures 3(c) and 3(d) show similarly complex behaviour of materials prices and wages. Real wages increased

very considerably over the period, with a fall in the mid 1970s coinciding with that of exports.

Table 1 Riedel's Long Run Supply Function

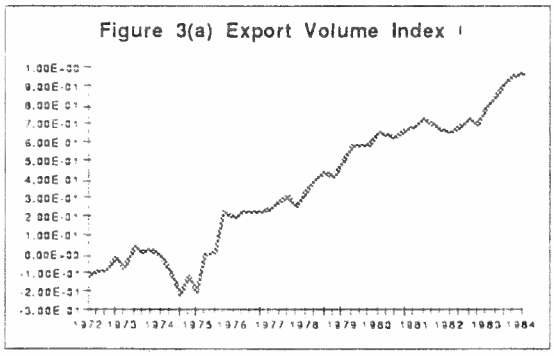
Q = 6.06(P-PW) - 4.67(PM-PW) -1.39(W-PW) + 0.03Z + c+Residual

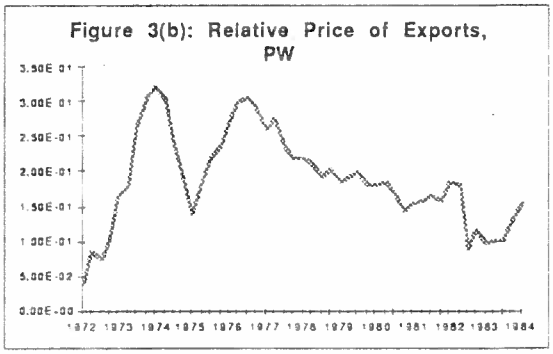
Analysis of changes:

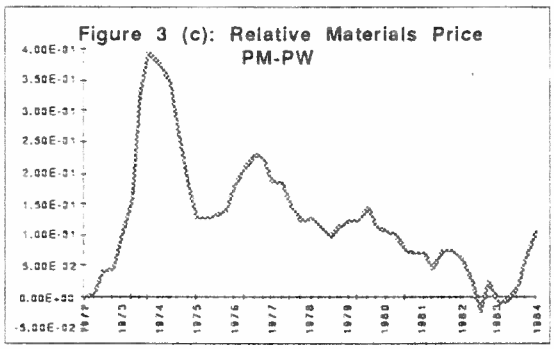
Variable:	ΔQ	Δ(P-PW)	Δ(PM-PW)	Δ(W-PW)	ΔZ	Resid
1972Q2-1984Q2						
ΔX_{ii}:	1.089	0.115	0.108	0.274	48	
$\beta_i \Delta X_i$:	1.089	0.696	-0.503	-0.381	1.330	-0.053
Contribution, %:	100	64	-46	-35	122	-5
1974Q1-1984Q2						
ΔX_{ii}:	0.9502	-0.154	-0.289	0.216	41	
$\beta_i \Delta X_i$:	0.9502	-0.933	1.349	-0.300	1.136	-0.301
Contribution, %::	100	-98	142	-32	120	-32

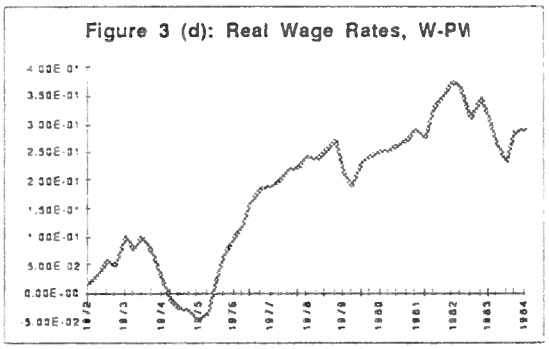
In Table 1 we attempt to account for the long-run growth in exports by decomposing it into components attributable to each of the explanatory variables in the supply function. We have attempted to account for the export increase using the estimated parameters to divide it into percentage changes due to each explanatory variable plus a residual. We have chosen to work with the structural form of the model rather than the reduced form because of the central role of the endogenous export price variable in this explanation. Whether a particular variable is endogenous or exogenous does not matter for this exercise since each structural equation in the model may be regarded as causal and we can carry out the analysis separately for each.

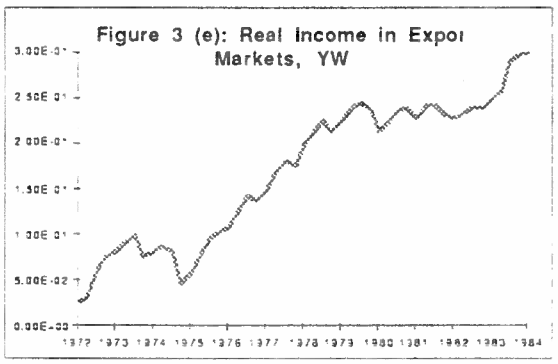
Figure 3: Relative Price and Income











Taking the full sample period, 1972Q2 to 1984Q2, no simple decomposition is found, with different variables moving in opposite directions. The greatest effect increasing exports is due to Z, capacity/productivity, proxied by the trend. There was also an increase in relative export prices, P-PW, which accounts for a large growth in exports. On the other hand, there were increases in materials prices, PM-PW, and wage rates, W-PW, which have contributed to a significant reduction in supply. The alternative analysis using domestic consumer

prices, PC, as the numeraire, rather than PW, leads to broadly similar conclusions.

Clearly the results of this analysis will depend to a large extent on the period chosen. Inspection of Figure 3 suggests that it might be illuminating to look at a shorter period when real export prices were falling and materials input prices also falling, although real wages were still rising, 1974Q1 to 1984Q2. The decomposition of export growth for this period shown in Table 1 does not give a convincing explanation either with materials prices, PM-PW, and Z giving very large increases and export prices, P-PW, and real wages, W-PW, suggesting a large decline in exports.

MSV(1992) re-estimated the model using the same data treating it as s simultaneous error-correction model using the Philips-Hansen procedure to estimate the cointegrating parameters. They therefore took explicit account of the non-stationarity of the data in estimation and hypothesis testing. They showed that the estimated demand function was relatively unaffected by the choice of normalisation and found that both price and income elasticity estimates were statistically significant. They reported a supply function with parameters not very different from those of Riedel. Their estimated long-run elasticities are reported in Table 2 together with an analysis of the contribution of each explanatory variable to the explanation of the growth of export demand. Figure 3(e) shows the behaviour of world income YW for comparison with that of Q.

Table 2 shows that the explanation of change in exports over the sample period 1972Q2 1984Q2 is dominated by changes in YW and that price changes make little contribution, even though the price coefficient

is statistically significantly different from zero. Over the full sample period the net effect of the export price change has been a small increase.

Table 2 MSV's Long Run Demand Function

$Q = -0.594(P-PW) + 4.239YW + c + Residual$

Analysis of changes:

Variable:	ΔQ	$\Delta(P-PW)$	ΔY	Resid
1972Q2-1984Q2				
ΔX_i:	1.089	0.115	0.273	
$\beta_i \Delta X_i$:	1.089	-0.068	1.156	0.002
Contribution, %:	100	-6	106	0.16
1976Q3-1984Q2				
ΔX_i:	0.686	-0.199	0.168	
$\beta_i \Delta X_i$:	0.686	0.118	0.712	-0.144
Contribution, %:	100	17	104	-21

In this section we have shown that in evaluating estimation results it is not sufficient only to report coefficients in term of their signs, magnitudes and statistical significance. It is necessary also to account for salient changes in the endogenous variable of interest by looking also at the magnitudes and directions of changes which have occurred in the causal variables underlying those coefficients.

III. THE "SMALL COUNTRY" HYPOTHESIS

Riedel did not simply estimate the supply function under the maintained hypothesis that Hong Kong's manufacturing sector faces a perfectly elastic demand function (the "small country" hypothesis). He tested it by a procedure in which it is a nested hypothesis on a general

demand function within a simultaneous equation model. A specification based on equation (1), the direct demand function, however does not easily allow this since the null hypothesis implies that a_1, the price elasticity of demand, is infinite. Working with the indirect demand function, equation (3), however, by choosing price as the endogenous variable whose coefficient is normalised to equal 1 allows a simple test of the small-country hypothesis. Riedel tests the joint hypothesis that $c_1=0$ and $c_3=0$ and finds it not rejected by the data and thereby establishes the crux of his case. We argue below, however, that this is not the appropriate test and therefore the test used by Riedel has low power.

Riedel's approach has been criticised by MSV(1992) who argued that in a simultaneous system the choice of normalisation is essentially arbitrary and even, if a maximum likelihood estimator is used which is invariant to normalisation, irrelevant, at least asymptotically. From the point of view of testing the null hypothesis of a zero price elasticity in the demand function, however, the choice of normalisation is limited. Writing the two-equation system in the conventional way as,

$By_t + \Gamma x_t = u_t$, where $y_t' = (Q_t \; P_t)$ is the endogenous variables vector, x_t is the appropriate vector of predetermined variables, etc., and the first equation is the demand function, then the endogenous-variables coefficient matrix B is, in general before normalisation,

$B = \begin{bmatrix} \beta_{11} & \beta_{12} \\ \beta_{21} & \beta_{22} \end{bmatrix}$. An infinite price elasticity of demand implies the restriction $\beta_{11}/\beta_{12} = 0$ which cannot be tested using the normalisation $\beta_{11} = 1$ and therefore, even if an estimator is used which is invariant to normalisation, this particular case still has to be excluded.

Riedel(1988) used the price-normalised inverse demand function in order to test the "small country" hypothesis. An infinite price elasticity means the restriction $c_1 = 0$ in equation (3), which can be tested as a restriction on a single coefficient whereas using the direct demand function (1) there is no such simple restriction. This argument is overstated however because an infinite price elasticity is an extreme limiting case and in practice the demand function will never be perfectly elastic. World demand is finite and the output of a country such as Hong Kong, although relatively small, is not infinitesimally so. We might therefore expect only a very high price elasticity and that an equation based on (1) would allow this to be observed.

All that is required to test the "small country" hypothesis is a test on the single coefficient c_1. Riedel however treats this hypothesis as synonymous with the assumption that the country's exports are independent of world income. Under the restriction $c_1 = 0$ the effect of changes in world income is to change the market price as in Figure 2. He tests this using the joint null hypothesis that $c_1 = 0$ and $c_3 = 0$. However if $c_1 = 0$, the parameter c_3 reflects the aggregate industry supply function and not the country demand function since the demand function is perfectly elastic at the exogenous price. A further issue is that the price variable is the price of Hong Kong's exports rather than that of a homogeneous good produced in a competitive world market.

The direct or quantity-normalised demand function in terms of the coefficients of equation (3) is

$$Q = -c_0/c_1 - 1/c_1 P - c_2/c_1 PW - c_3/c_1 YW$$

If exports are independent of world income this implies the restriction $c_3/c_1 = 0$. The joint test of c_1 and c_3 being individually equal to zero is

not a powerful test of this restriction because we would expect both of these parameters to be small for the reasons mentioned above.

The standard Wald test of the null hypothesis H_0: $\beta = 0$ for a vector of r coefficients β whose unrestricted estimator b has covariance matrix V uses the statistic $W = b'V^{-1}b$ which has a χ^2 distribution with r degrees of freedom if H_0 is true. Under the alternative hypothesis H_1: $\beta = \beta_1$ this statistic has a non-central χ^2 distribution with non-centrality parameter $\beta_1'V^{-1}\beta_1$. The power of the test depends directly on this magnitude. In this case r = 2 and $\beta_1' = [c_1\ c_3]$ and it can be seen that the non-centrality parameter depends on the absolute values of c_1 and c_2 and not their ratio. Very small values of c_1 and c_3 are consistent with any value of the ratio. Therefore the power of the test will be small. There is therefore a high probability that a joint hypothesis of the form H_0 will be accepted. The appropriate testing procedure is a direct test of the significance of the coefficient of YW in the direct demand function.

IV. CONCLUSION

We have argued that in interpreting econometric evidence as an explanation for a phenomenon of interest it is insufficient simply to look at parameter estimates in terms of signs and numerical magnitudes. Consideration must also be given to the nature of changes in the explanatory variables within the assumed causal model. Quantitative measures of explanatory power based on variance such as R^2 are not sufficient. It is necessary to make a qualitative analysis of both the direction and extent of movement in all variables and to compare their effects using the estimated parameters.

Applying this to previous estimates for Hong Kong we are led to the conclusion that changes in income in export markets in developed countries have been considerably more important as an explanation for the growth in exports than supply-side improvements in price competitiveness. We have also argued that a test for the independence of an LDC's exports of income in export markets in developed countries which has been used in previous work will have low power and is therefore inappropriate.

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[1]We also intend to provide new estimates improving on these using new data in two ways. We propose (in accordance with a similar point made by MSV and Muscatelli (1994)) that the estimated price elasticity may be biased because of quality changes in the goods and we will employ a specification which implicitly adjusts the price variable for quality change. We also argue that it is necessary to take account of the increasing importance of trade with China since 1978, a factor which has been largely neglected by the previous studies.

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