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EXPORT FUNCTIONS FOR PAKISTAN:
A Simultaneous Equations Approach

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This paper suggests that the export performance of Pakistan can be well analyzed by considering both supply and demand sides simultaneously. Following Goldstein and Khan (1978) we formulate a simultaneous equations equilibrium model for Pakistan's exports. Our two-equation model, which is estimated for primary and manufactured goods exports for the period, 1960-80, is directly comparable with the estimated export supply equations reported in P.I.D.E.'s macroeconometric model. The estimation of our model using 2SLS provides consistent estimates of the export elasticities. As expected, Pakistan being a small open economy, price responses are not significant while world income and domestic production of exportables significantly explains the demand and supply sides of exports respectively.

I. Introduction

In most of the studies available on Pakistan's exports demand side of exports is assumed to be exogenous,[1] e.g., Naqvi [(1982) and (1983)]. In order to understand Pakistan's export behavior clearly, simultaneous study of export supply and demand relationships is essential. Thus, the ultimate purpose of this paper is to estimate consistent elasticities of both export demand and export supply by using annual data on primary and manufactured goods export of Pakistan for the period, 1959-60 to 1979-80.

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[1] In case of some other countries generally export supply is considered exogenous. The usual assumption is that export supply price elasticity facing an individual country is infinite, e.g., Houthakker and Magee (1969), Taplin (1973), and Hickman and Lau (1973).

The idea of simultaneous estimation of export demand and supply is not new. Morgan and Corlett (1951) is an earlier attempt towards this goal. Khan and Goldstein (1978) used a simultaneous equation model to estimate export supply and demand functions for eight countries.

The plan of the paper is as follows: in section II we specify the functions to be estimated; section III contains data definitions and sources; the results obtained from estimating the demand and supply equations are presented and discussed in section IV; section V contains concluding remarks and limitations of the study.

II. The Model

The world demand for Pakistan's manufactured and primary goods is specified in log-linear form as follows:[2]

$$\log X_t = a_0 + a_1 \log (PX/PW)_t + a_2 \log WWI_t + a_3 D_t$$

where

X = Real value of exports;
PX = Pakistan's export price;
PW = World export price;
WWI = Weighted average of the real incomes of Pakistan's major trading partners;
D = Dummy for shift in demand due to loss of a major export market in 1971-72[3], as a result of separation of the former East Pakistan.

Since the above equation is specified in logarithms, a_1 and a_2 are the relative price and real income elasticities of export demand respectively. On *a priori* grounds it is expected that a_1 will be negative and a_2 positive.

The supply of exports is specified as follows:[4]

$$\log X_t = b_0 + b_1 \log (PX/PG)_t + b_2 \log Q_t$$

where

X = Real value of exports;
PX = Pakistan's export price;
PG = Pakistan's G.N.P. price index;
Q = Domestic production of exportables.

[2] Excluding dummy variable (D), this specification of export demand function is almost the same as in Houthakker and Magee (1969), and Khan and Goldstein (1978).

[3] Bangladesh, formerly East Pakistan, is considered a separate country for the entire period of study.

[4] Specification of export supply function is not different from Naqvi (1983).

The relative price variable in the above supply equation represents effective export rate. On *a priori* basis b_1 is expected to be negative while b_2 is expected to be positive.

The above specified model is estimated for manufactured and primary goods by using Two Stage Least Squares (2SLS).

III. Data Sources and Definitions

All data are annual, for the period 1959-60 to 1979-80, and are taken from the following sources:

1. International Monetary Fund: International Financial Statistics, (various issues).
2. UNO: World Trade Year Book, (various issues).
3. World Bank: World Bank Tables 1976, 1980.
4. Govt. of Pakistan, Ministry of Finance: Pakistan Economic Survey, 1980-81, Islamabad, 1981.
5. Naqvi, S.N.H., and Others: the P.I.D.E. Macro-econometric Model of Pakistan's Economy, Islamabad, P.I.D.E., 1983.

All data, except on WWI (which is in US dollar), are expressed in domestic currency units.

WWI which represents the weighted average of the real incomes of Pakistan's major trading partners is constructed as follows:

$$WWI_t = \sum_{i=1}^{22} d_i \, G.N.P._{it.} \qquad (t = 1960 \ldots 1980)$$

where

d_i = Geometric average of the weight of country i in Pakistan's aggregate exports to 22 countries during 1960, 1965, 1970, 1972, 1974, 1976, 1978 and 1980;

$G.N.P._{it}$ = Gross National Product of Country i in year t in 1980 prices in US dollars.

IV. Empirical Results

The functional relationships specified in section II have been estimated by using 2SLS. The results of estimation are discussed below. The values in parenthesis under the estimated coefficients are computed 't' values. Any statistic[5] (t or D.W.) marked by asterisk (*) or double asterisk (**) shows that the computed value is significant at 5 per cent or 10 per cent level of

[5] Although meaning of Durbin-Watson statistic (DW) is not clear in simultaneous equation models we have reported it.

significance respectively. The coefficient of determination, R^2, is also calculated for the individual equations although its meaning in simultaneous models is at best ambiguous. This is because R^2 is not bounded $(0, 1)$ but $(-\infty, 1)$ so that small values are not an indicator of a 'poor' fit. The estimated supply and demand equations are given below:

Primary Goods Export

$$\log XP = \underset{}{3.20} - \underset{(-0.18)}{0.066} \log (PX/PW) + \underset{(4.17)^*}{1.05} \log WWI - \underset{(-1.28)}{0.25D}$$

$$n = 21 \qquad R^2 = 0.72 \qquad DW = 1.77^*$$

$$\log XP = \underset{}{-3.01} - \underset{(-1.43)}{0.26} \log (PX/PG) + \underset{(5.96)^*}{1.13} \log Q$$

$$n = 21 \qquad R^2 = 0.71 \qquad DW = 1.67^*$$

where

XP = Value of primary goods export in 1980 prices;
PX = Pakistan's export price index for primary goods, 1980 = 100;
PW = World export price index for primary goods[6], 1980 = 100;
WWI = Weighted average of real incomes of Pakistan's major trading partners (1980 prices);[7]
D = Dummy for shift in demand due to loss of a major export market in 1971-72;
PG = Pakistan's G.N.P. price index, 1980 = 100;
QP = Value added in Pakistan's agricultural sector in 1980 prices.

World income (WWI) is the major determinant of the demand for Pakistan's primary goods in international markets whereas the relative price though bearing correct sign is not significant which shows that Pakistan is a price taker in international markets. The negative coefficient of the dummy variable shows that there is a downward shift in demand for Pakistan's primary goods export but this shift is not significant. Income elasticity

[6] Due to unavailability of data on export prices of manufactured and primary goods for a large number of Pakistan's major trading partners we were forced to use world export price index for manufactured and primary goods.

[7] We have constructed World income variable (WWI) by weighting the G.N.P. of 22 countries by their relative share out of total Pakistani exports to these countries. Ideally G.N.P. should be weighted by the relative share of primary goods export to each country for primary goods export demand functions. However, it was not possible to collect this information for each country over the entire sample period.

for primary goods export is slightly larger than unity which means that demand for primary goods in international markets is income elastic.

The estimates of supply elasticities are higher than Naqvi[8] (1983) where elasticity of agricultural income is 0.78 and of effective export rate (PX/PG) is 0.11. In the present case it is 1.13 and 0.26 for agricultural income and effective export rate respectively. On the basis of econometric theory our estimates of export elasticity are better than Naqvi (1983). This is so because Naqvi (1983) is a special case of our model where estimation is carried out by using OLS. Clearly, estimates of export supply elasticities reported in Naqvi (1983) are inconsistent.

Manufactured Goods Export:

$$\log XM = 1.89 - 1.38 \log (PX/PW) + 1.28 \log WWI + 0.03D$$
$$(-1.04) \qquad (1.75)^{**} \qquad (0.06)$$

$$n = 21 \qquad R^2 = 0.76 \qquad DW = 1.87^{*}$$

$$\log XM = 0.02 - 0.18 \log (PX/PG) + 0.96 \log QM$$
$$(-1.56) \qquad (10.45)^{*}$$

$$n = 21 \qquad R^2 = 0.88 \qquad DW = 1.68^{*}$$

where

XM = Value of manufactured goods export in 1980 prices;
PX = Pakistan's export price index for manufactured goods, 1980 = 100;
PW = World export price index for manufactured goods, 1980 = 100;
WWI = Weighted average of real incomes of Pakistan's major trading partners (1980 prices);
D = Dummy for shift in demand due to loss of a major export market in 1971-72;
PG = Pakistan's G.N.P. price index 1980 = 100;
QM = Value added in Pakistan's large scale manufacturing industries in 1980 prices.

As in the case of export of primary goods, weighted world income figures significantly in explaining the export behaviour of manufactured goods. In the present case both income and price elasticity of demand are larger than unity but the latter is insignificant even at 10 per cent level of significance. Unlike primary goods export there is an upward shift in the demand function in 1971-72 but this shift too is insignificant.

[8] Sample period in Naqvi (1983) is 1959-60 to 1978-79.

The supply equation provides a significantly different elasticity with respect to relative price as compared with Naqvi (1983) where reported elasticity is 0.18. On the other hand output elasticity is not very different from Naqvi (1983) where it is 0.93.

V. Conclusions

This paper has shown that Pakistan's export behaviour can be explained meaningfully by a simultaneous equations model. The empirical results suggest that estimates of export supply elasticities can be substantially different when export demand relationships are explicitly taken into account.[9] As such, it can be claimed on the basis of econometric theory that our estimates of export supply elasticities are superior than those reported in Naqvi (1983).

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[9] Same type of conclusion is drawn in Khan and Goldstein (1978).