Determinants of Exports of Pakistan:
A Country-wise Disaggregated Analysis

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1. BACKGROUND

Exports are believed to be the engine of economic growth. A nation can win friends through trade relations and ensure an optimal allocation of the available resources. Following the comparative advantage principle, each country is likely to export those goods which can be produced at relatively low costs. The returns from trade depend on enhancing domestic production, ensuring international standards and exploring new markets for exports. The export performance of a country is determined by many factors, which can be categorised in terms of demand and supply side determinants. The demand side factors include capacity of the trading partners, the prices of exportable goods, the prices of competing/substitute goods in the world market and the exchange rate etc. However the political and social factors also play a very crucial role in this regards. The supply side factors include domestic productive capacity, exchange rate, relative prices (prices of exports relative to prices of competing goods), wage rate and import of inputs etc. On the demand side, the world price and world income have an important role in explaining export performance, whereas on the supply side, the domestic productive capacity and the availability of inputs are important.

Some researchers emphasise on significance of the demand side determinants while others attribute more importance to the factors on supply side. In this context, the magnitudes of price and income elasticities on demand side need due consideration. Muscatelli (1992) finds the income and price elasticities of export demand to be significant but finite; whereas Reidel (1988) considers these elasticities to be significant and infinite. Apart from income and relative price responsiveness to exports, the predominant views indicate the importance of supply side and other related constraints. For instance, Khan and Knight (1985) show that import of inputs have significant influence on export performance in the long run. Sinha Roy (2002, 2007) and Muscatelli (1992, 1995) consider the relative prices (foreign prices of exportable goods relative to the domestic prices) to play a significant role in this context. Majeed and Eatzaz (2006) also highlight the importance of some supply side determinants. Given the differences in

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views of researchers, there is sufficient rationale to examine the relative importance of the demand and supply side determinants simultaneously so as to arrive at some meaningful conclusions

2. RATIONALE/RELEVANCE OF THE STUDY

Numerous empirical studies on exports are available with reference to Pakistan, following different estimation approaches and methodologies. Most of these studies have relied on single equation models, incorporating both the demand and supply side determinants of exports mixed together. This approach has often led to misleading results due to the aggregation of different classes of variables. The robust and precise estimates can be obtained only if the demand and supply side equations are carefully specified with appropriate variables. Since there are two endogenous variables in export function, i.e., quantity and the price of exports, these have to be determined simultaneously. This may lead to simultaneous equations bias and yield misleading results if not handle properly.

This study is the first of its kinds that attempts to rely on the country-wise disaggregated export analysis since no study is available on this pattern. Keeping in view the share of each partner in our exports and availability of the data on the variables concerned, a moderate sample of eleven countries is selected for the purpose. This includes USA, UK, Germany, France, Korea, Kuwait, Mauritius, Malaysia, Canada, Bangladesh and Saudi Arabia. A significant contribution of this study is incorporation of the import of inputs in the supply side equation. We intend to test the hypothesis that import of inputs (industrial raw material and capital goods) increases the export potential of the country and lead to favourable balance of trade. The study also examines the impact of Kuwait-Iraq war (1991) and Afghanistan war (2001-02) on our exports performance. It is generally argued that the flow of Pakistan's exports to European and NAFTA regions has been adversely affected due to these wars. Another contribution of this study is the application of the Empirical Bayesian technique to test the reliability of the ordinary estimates.

3. OBJECTIVES OF THE STUDY

The research is intended to achieve the following objectives.

(1) The foremost objective of this study is to determine the nature of relationship between exports and their determinants, taking into consideration both the demand and supply sides.

(2) After having studied a vast literature, it is revealed that most studies have relied on demand side determinants of exports since they assume the supply side to be infinitely elastic. Several other justify significance of the supply side determinants. An associative objective is to see the relative importance of the demand and supply side determinants in explaining export performance of Pakistan.

(3) Many developing countries including Pakistan are facing persistent deficit in balance of payments due to heavy import bill. They have adopted commercial policies to suppress imports and to get rid of the resulting deficit in trade account. But this could be at the cost of reduction in country's

potential for exports, since the import of raw material and equipments is believed to be critical for export production. This may deepen further the deficit in BOP. Thus one of the objectives is to evaluate the importance of import of inputs in explaining exports behaviour.

(4) The recently fought American-led two wars i.e., the Kuwait-Iraq war (1991) and Afghanistan war (2001) are considered to have seriously affected the trade relations among countries with in the region and off the region. The export destination and export flows have been adversely affected. Therefore another objective of the study is to see the impact of these wars on our export performance.

4. REVIEW OF LITERATURE

Several studies have been conducted by different people to pinpoint the determinants of exports and to analyse their impact on export performance. Most of the researchers have used single equation export models, incorporating both the demand and supply side determinants. Many others adopted the simultaneous equation framework, in which the demand and supply side functions are specified with appropriate variables. However there is seldom consensus in their views about the demand and supply side influences. Some studies establish the importance of demand side determinants while others attribute more importance to the supply side factors. Some of the studies on exports determinants are briefly discussed below.

Khan and Night (1985) have employed the Two Stage Least Square (2SLS) to examine the relationship between import of inputs and export performance for a sample of 34 of developing countries, using time series data over the period 1971-80. The export demand and supply functions were specified with income and relative prices with the addition of import of inputs in the supply side equation. Likewise the import demand function was specified with income, relative prices (price of imports relative to domestic prices) and the foreign exchange availability. The findings revealed that import of inputs had a positive and significant impact on export performance whereas the foreign exchange reserves had a negative but relatively less significant impact on imports.

Reidel (1988) used the simultaneous equations approach to examine the demand and supply side determinants of exports quarterly time series data over the period 1972-1984. Export prices, price of competing goods in world market and world demand were used as exogenous variables in the demand side equation while the domestic price of exports, price of raw material, industrial inputs and time trend were used as independent variables in the supply side equation. The results showed infinite price and income elasticities of exports demand, which supported the small country hypothesis. All the parameters of the wage as well as supply side export equations appeared with correct signs and significant magnitudes except the time trend variable 't' which carried insignificant coefficient, although correctly signed.

Funk and Holly (1992) have employed the Full Information Maximum Likelihood method to estimate the demand and supply side export functions for three different categories of exports i.e., the total manufactured exports, mechanical engineering and motor vehicle exports of the West Germany. The quarterly time series data was applied over the period 1961-1987. The demand equation was specified with the prices of

exports, prices of competing/substitute goods at world market, world demand (proxied by the OECD's exports). The supply side equation was specified with domestic price of exportable goods, foreign prices of exports, total costs and capital stock. All the demand and supply side elasticities carried significant magnitudes across the categories except the price elasticity of export demand which was found to be insignificant for the total manufactured and mechanical engineering goods exports.

Muscatelli, *et al.* (1992) have employed the Modified OLS to examine the determinants of the Hong Kong's exports, using quarterly time series data over the period 1972-1984. The export demand equation has been specified with prices of exports, prices of competing goods and world income, while the prices of exports, the prices of raw materials and unit labour costs have been used as exogenous variables in the supply side equation. The findings suggest significant but relatively small price elasticity and significant but relatively high income elasticity of export demand. On the supply side, only the wage rate turned out to be insignificant.

Reidel, *et al.* (1994) have examined the determinants of exports of Hong Kong to test the small country hypothesis, using quarterly time series data ranging from 1977:1 to 1984:4. The price dependent export demand equation has been specified with volume of exports, prices of competing goods at world market and world income as independent variables. The results showed significant and infinite income and price elasticities of export demand, implying that Hong Kong is a small price taker economy.

Muscatelli, *et al.* (1995) have examined the determinants of exports of the newly industrialised Asian economies, including Hong Kong, Korea, Taiwan, Singapore, Malaysia and Thailand, using a time series data over the period 1967-1987 and employed the Full Information Maximum Likelihood method for estimation. The results suggest significant income and price elasticities of exports demand for all the countries, thus rejecting the small country hypothesis that world demand is irrelevant in explaining export behaviour of the newly industrialised economies.

Roy (2002) has employed Full Information Maximum Likelihood method to estimate the demand and supply side exports equations for India over the period 1960-2000. The dynamic error correction model was estimated in which the error correction representation in the demand side equation carried significant and lager magnitude, indicated that the demand side factors significantly explain the short run dynamics of the export performance. All other variables in the model were found to be significant except the scale variable of the supply side, which was insignificant although correctly signed.

Atique and Ahmed (2003) have empirically analysed the determinants of exports of Pakistan. The export demand and supply functions were specified and estimated separately. The explanatory variables comprised world economic activity and real exchange rate in the export demand function while relative prices, domestic GDP and wage rate per worker were employed to explain the export supply function. REER and industrial production index (proxy for world economic activity) were found to be significant in the long run, although current and lagged values of REER were found to be insignificant. On the supply side, the cumulative effect of wage rate was found to be significant but not so at individual level. The domestic production capacity on the supply side appeared with positive and significant coefficient.

Afia (2004) has examined the determinants of textile and clothing exports of Pakistan, using a time series data over the period 1960-200. The demand and supply side exports equation were estimated in a simultaneous equation frame-work. The coefficient on the price of textile exports and world income appeared with correct signs but turned out to be insignificant. All the coefficients on the supply side were found to be statistically significant with correct sign.

Roy (2007) has estimated the demand and supply functions of the manufactured exports for India, using a time series data over the period 1960-2004. The FIML has been used to estimate the demand and supply side exports for six different categories of manufactured exports including cloth and garments, chemicals and machinery, transport equipments, steel and iron, and the leather manufactures. The findings suggest importance of all demand side factors for exports performance. On the supply side, the variables produced mix results in terms of significance and some variables like world GDP and exports volume turned out to be insignificant for textile and iron-steel exports respectively.

Keeping in view the above discussion, it is evident that studies regarding the determinants of exports in Pakistan are very rare. The available studies like Atique and Ahmed (2003), Afia (2004) and Afzal (2005) etc. are not comprehensive and suffer from methodological and estimation weaknesses. In contrast, there are only few international studies that have followed comprehensive approach in specification of both demand and supply side. The present study is intended to fill up the gaps in specification and estimation. We develop a simultaneous equation framework and test the demand for and supply of export functions separately for a number of export partners of Pakistan. Another distinction is the way we attempt to estimate the concerned equations. We employ the GMM technique in the first step and use the information in the second step of Bayesian estimation framework. The estimates so obtained are likely to be more consistent and reliable.

5. MODEL SPECIFICATION AND METHODOLOGY

The foreign trade models are specified by different researchers following different approaches. However there is a general consensus in literature about the empirical form of demand for and supply functions of exports. The standard approach is the "imperfect substitute model", which assumes that neither imports nor exports are perfect substitutes of domestic goods.[1] Keeping this in view, the consumers in the trading partners' economies are assumed to maximise their utility subject to budget constraint. The resulting demand function depends on the level of income in the economies concerned, the price of exports and price of substitute goods in the world market.[2] The specification of supply-side export equation is also straightforward within the 'imperfect substitute model'. The producers in the domestic economy are assumed to maximise their profits subject to cost constraint. This yields export supply function, depending on the productive capacity and relative prices i.e. foreign prices of exports relative to the domestic prices of exportable goods.

[1]See Stein and Khan (1985).

[2]It is equivalent to say that the demand for exports depends on the level of foreign economic activity and the Real Exchange Rate. Because the RER is calculate in terms of price of exports and price of competing goods at world market.

We follow Stein and Khan (1985) and specify the export demand and supply functions with two necessary extensions. First, we introduce two dummies in the demand side equation to examine the impact of US-Iraq war (1991) and US-led Afghanistan war (2001). Second, we include the import of inputs in the supply side equation to see their impact on export performance of Pakistan. The demand and supply side equations in the extended form are specified as follows;

5.1. The Standard Export Model

$$\text{Export Demand Equation}\quad X^d_t = \alpha_0 + \alpha_1 RER_t + \alpha_2 Y^w_t + \alpha_3 D + U_t \qquad \dots (5.1)$$

$$\text{Export Supply Equation}\quad X^s_t = \beta_0 + \beta_1 RP_t + \beta_2 Y^d_t + \beta_3 M_t + V_t \qquad \dots (5.2)$$

X^d—the quantity of export demanded, RER- real exchange rate and is written as; $RER = P^x/eP^w$, where 'P^x' is the foreign price of exports, 'P^w' is the price of competing/substitute goods and 'e' is the nominal exchange rate of domestic economy with respect to the trading partners' economies. We use the export unit value of Pakistan and the import unit values of our trade partners to measure 'P^x' and 'P^w' respectively.[3] 'Y^w' is the world demand for domestic exports which is approximated by Gross Domestic Product (GDP) of our trading partners.[4] 'D' *is* the dummy variable that captures the impact Kuwait-Iraq war (1991) and the US-led Afghanistan war (2001) on our exports behaviour. 'X^s' in (2) is the supply of exports. 'RP' is the relative price of exports i.e., the price of exports relative to the domestic price of exports, that is 'RP' $= \frac{P^x}{P^d}$. 'P^x' is the price of exports at world market. 'P^d' is the domestic price of exportable and is proxied by the 'whole price index' *(WPI)* of Pakistan.[5] 'Y^d' is the supply side scale variable which is proxied by Gross Domestic Product of Pakistan (GDP). 'M' is the imports of inputs. We take the log transformation and rewrite the demand and supply function as follows;

$$logX^d_t = \alpha_0 + \alpha_1 log\, P^x_t + \alpha_2 log\, e.P^w_t + \alpha_3 log\, Y^w_t + \alpha_4 D_{91} + \alpha_5 D_{01} + u_t \quad \dots (5.3)$$

$$logX^s_t = \beta_0 + \beta_1 log\, P^x_t + \beta_2 log\, P^d_t + \beta_3 log\, Y^d_t + \beta_4 log\, M_t + v_t \qquad \dots (5.4)$$

The coefficients α_i and β_i are elasticities with respect to the variables concerned. The coefficients 'α_2', 'α_3', 'β_1' β_3 and β_4 are expected to appear with positive signs; that is α_2, α_3, β_1, β_3, $\beta_4 > 0$, while α_1, α_4, and β_2 are expected to carry negative signs; that is α_2, α_3, $\beta_1 < 0$. This model is an equilibrium model and there are two endogenous variables in it, i.e., export quantity and exports prices which have to be jointly determined.

5.2. Normalising the Demand and Supply Functions;

Estimation of simultaneous equation model needs the equations to be normalised i.e., restricting the coefficient of one of the variable to '1'. The normalisation procedure is

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[3]Stein and Khan (1978), Mscatelli (1992) and Roy (2002) have used the export unit value for the price of exports and import unit value of the trading partners to measure the price of the foreign substitute.

[4]Stein and Khan (1988) have used the real GDP of the trading partners to measure the world demand. Reidel (1988) has used real GNP. Muscatelli, *et al.* (1992) have used the real GDP while Roy (2002, 2007) has used the aggregate imports of the trading partners to measure the world demand for exports.

[5]Stein and Khan (1985) have used CPI, while Muscatelli, *et al.* (1992), Funk and Holly (1992) and Sinha Roy have used 'WPI' to measure the domestic price of exports.

found different in different studies. Reidel (1988) has normalised the export demand function with export price and export supply function with export quantity.[6] Muscatelli (1992), Roy (2002, 2007) and Funk and Holly (1992) used the opposite type of normalisation i.e. the export demand equation by quantity and export supply equation by price. We normalise the demand and supply functions, using the second approach i.e. the demand function by export quantity and supply equation by export price. The quantity dependent export demand equation and the price dependent export supply function or the inverse supply functions are written as follows;

$$log\, X_t^d \;=\; a_0 + a_1 log\; P_t^x \;+ a_2 log\; e\, .P_t^w \;+ a_3 log Y_t^w \;+ a_4 D_{91} + a_5 D_{01} + u_t, \qquad (5.5)$$

$$log\, P_t^x \;=\; \gamma_0 + \; \gamma_1 log\, X_t^s + \; \gamma_2 log\, P_t^d \;+ \; \gamma_3 log\, Y_t^d \;+ \; \gamma_4 log\, M_t \;+ v_t \qquad \dots \; (5.6)$$

Equation (5.5) is a volume adjustment equation and Equation (5.6) is a price adjustment equation. X^d is seen as dependent variable in Equation (5.5) and P^x is seen as dependent variable in Equation (5.6). X^d and P^x are said to be the two endogenous variables in the system which have to be determined simultaneously. This means that the two equations are interdependent and none can be estimated independently. To estimate this type of model, the reduced form of the model is obtained which is estimated via Indirect Least Square to avoid the possible simultaneity problem. The second approach is to estimate the demand and supply functions in the simultaneous equations framework. We avoid the reduce form approach and use the simultaneous equation approach to estimate the set of equations.

5.3. The Estimation Strategy/Methodology

Before any regression analysis on time series data, it is necessary to check the series for the order of integration or to check the series for stationarity. It is believed that most of the time series have a unit root i.e., they are non-stationary which can be transformed into stationary series through differencing. We use the Augmented Dickey Fuller test to see the order of integration among the variables concerned.

Two or more variables are said to be co-integrated if they have a long run relationship among them. If the variables do not have a long relationship, there remains no economic concern. Therefore it is necessary to check weather the variables in a regression equation are cointegrated or not. Different people have proposed different tests to check co-integration among the variables. We use the Johenson cointegration test to check co-integration among the variables.

Engel and Granger (1987) had proposed the Static OLS to estimate the system of equations like above. But this procedure suffers due to two problems as pointed out by Benergy (1989). Second: endogeneity in regressors. Phillips and Hansen (1991) have justified the use of Modified OLS which can overcome both of these problems. Roy (2002) employed the Two Stage Least Square (2SLS) to estimate the system of equations like above. The system estimation methods like Three Stage Least Square (3SLS), The

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[6]Reidel (1988) argued that normalising export demand equation with price and supply equation by quantity, yield results which support the small country hypothesis. Muscatteli, *et al.* (1992) show that it does not matter, how you normalise the demand and supply function but if one employ a system estimation method rather single equation method, one would get significant income and price elasticities of export demand.

Full Information Maximum Likelihood (FIML) and Generalised Method of Movements (GMM) are among the preferred methods to estimate the system of equations. Keeping in view the small size of the sample, we use the Empirical Bayesian procedure to estimate the system of equations. The Empirical Bayesian procedure is believed to provide efficient and much precise estimates than all of the above.[7] But before employing the empirical Bayesian technique, we use the GMM to estimate the set of equations and the estimates obtained are then utilised to develop the Empirical Bayesian formula. Both of these techniques are discussed below.

5.3.1. *The Generalised Method of Movements*

The Generalised Method of Moments is believed to be efficient among other estimators as it can overcome many problems like endogeneity in regressors etc. This procedure is widely used by the researchers but in small samples, it yields misleading results. We do not purely rely on the GMM; therefore we do not go into detail. Our main focus is on the performance of the Empirical Bayesian technique but we employ the GMM so that the results might be utilised to develop the Empirical Bayesian formula.

5.3.2. *The Empirical Bayesian Estimator*

The Empirical Bayesian Procedure is believed to be efficient over a class of other estimators especially in small samples. It has several advantages over other estimators that lead to much precise and reliable estimates. This assumes that the priori information about the unknown parameters to be represented in the form of a density function;

$$\hat{\beta}_i \, / \, \beta_i \sim N(\, \beta_i \, , \Lambda_i \,), \qquad \ldots \qquad \ldots \qquad \ldots \qquad \ldots \qquad \ldots \qquad \ldots \quad (5.7)$$

'$\hat{\beta}_i$' is the estimated elasticities whereas 'β_i' is the true values of the elasticities. Equation (5.7) states that the 'estimated values' of the parameters has a normal distribution with mean β_i, and variance 'Λ_i' given the true values of the parameters. The Empirical Bayesian Estimator is obtained by assuming that 'β_i' has a normal prior distribution of the form;

$$[\, \beta_i | \, \mu, \, \Omega \,] \, \sim \quad N(\, \mu, \, \Omega) \qquad \ldots \qquad \ldots \qquad \ldots \qquad \ldots \qquad \ldots \quad (5.8)$$

This implies that β_i has normal distribution with mean 'μ' and variance 'Ω'. Where, 'Ω' is the variance of the prior density which has been calculated from the GMM results. That is;

$$\Omega = [\, \textstyle\sum_{i=1}^{n}, \, \Lambda_i^{-1} \,]^{-1} \qquad \ldots \qquad \ldots \qquad \ldots \qquad \ldots \qquad \ldots \quad (5.9)$$

The variance of the prior density 'Ω' is simply the weighted average of the variance covariance matrices of the GMM estimates.[8] We follow Corrington and Zaman (1994) to calculate the variance covariance matrices of the parameters using the estimated standard errors of the GMM estimates obtained in the first stage, restricting the off-

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[7]This is due to the additional information that is added to model which allow getting reliable and precise estimates of the variables.

[8]The inverse of the variance covariance matrix is also called the precision of matrix in Bayesian calculation. See the "Statistical Foundation for Econometric Techniques" by Asad Zaman, pp. 44.

diagonal element of the covariance matrix to be zero and assuming no prior covariance across the coefficients. 'μ' in (5.8) is mean of the prior density and is given as;

$$\mu = \Omega^{-1}\left[\ \sum_{i=1}^{n}\ \Lambda_i^{-1}\ \hat{\beta}_i\ \right] \quad \cdots \quad \cdots \quad \cdots \quad \cdots \quad \cdots \quad \cdots (5.10)$$

Equation (5.10) implies that utilising the GMM results and the variance of the prior density, we arrive at the mean of the prior density. Once we obtain the mean and variance of the prior density, we proceed to find the mean and variance of the posterior density to arrive at the Empirical Bayesian formula. The posterior density of the data is given by

$$\beta_i\ /\ \hat{\beta}_i\ =\ \sim\ N\ (\mathrm{m},\ \mathrm{V}) \quad \cdots \quad \cdots \quad \cdots \quad \cdots \quad \cdots \quad \cdots (5.11)$$

'm' and 'V' in (5.11) are respectively the mean and variance of posterior density. The variance 'V' is simply calculated from the variance covariance matrices 'Λ_i' and variance of the prior density 'Ω''. That is;

$$V = (\ \Lambda_i^{-1} + \ \Omega^{-1})^{-1} \quad \cdots \quad \cdots \quad \cdots \quad \cdots \quad \cdots \quad \cdots (5.12)$$

Having obtained the variance of the posterior density, we can estimate the mean of this density by using 'V' and parameters of the prior density as under;

$$\mathrm{m} = V\left(\ \Lambda_i^{-1}\hat{\beta}_i\ +\ \Omega^{-1}\mu\right) \quad \cdots \quad \cdots \quad \cdots \quad \cdots \quad \cdots \quad \cdots (5.13)$$

In Equation (5.13) '$\hat{\beta}_i$' are the GMM estimates and μ and V are the mean and variance of the prior density respectively. It is evident that the posterior density utilises the data information and the prior information in the form of prior density. The Empirical Bayesian estimator, which is obtained from the posterior density, is given by;

$$\hat{\beta}^{EB} =\ V\left(\ \Lambda_i^{-1}\hat{\beta}_i\ +\ \Omega^{-1}\mu\right) \quad \cdots \quad \cdots \quad \cdots \quad \cdots \quad \cdots \quad \cdots (5.14)$$

Equation (5.14) is the Empirical Bayesian formula of the parameters estimates. The standard errors of the estimates are obtained from the variance of the posterior density 'V'.

5.4. Sample Size and the Data

Annual data for the period 1975-2008 has been considered for the analysis over a sample of 11 countries. Data on Pakistan's imports and exports to the trading partners has been taken from different issues of the Statistical Supplements to the Economic surveys published by the Finance Division/Ministry of Finance. Likewise data on GDP, exchange rate and imports has been taken from the world development indicator (WDI). Data on the import unit value, export unit value, CPI and WPI have been obtained from International Financial Statistics (IFS).

6. RESULTS AND DISCUSSION

In this section we compare and analyse the results of the two estimation techniques i.e. GMM and the Empirical Bayesian technique. Before employing these techniques, we have employed the Augmented Dickey Fuller test to see the order of integration among the variables concerned. All the were found to have the same order of integration i.e. $I(1)$.

We have used the Johenson Cointegration technique to test Cointegration among the variables. The results reveal that all the variables are cointegrated and they have long run equilibrium relationship among them.[9]

6.1. The GMM Estimates

'α_1' is the price elasticity of export demand, 'α_2' is the cross price elasticity 'α_3' is the elasticity of demand with respect to the GDP of our trading partners. Likewise 'β_1', 'β_2' and 'β_3' are the prices and income elasticities of exports supply. 'β_4' is the elasticity of export supply with respect the imports of 'inputs'. The country-wise disaggregated structural demand and supply side export functions have been estimated initially with Generalised Method of Movements (GMM) and the results are reported in Table 1.

Table 1

GMM Results of the Demand and Supply Export Functions

Trade Partner Coeff.	$X^d_t = \alpha_0 + \alpha_1 P^x_t + \alpha_2 e . P^w_t + \alpha_3 Y^w_3 + \alpha_4 D_{91} + \alpha_5 D_{01}$ Export Demand Function						$X^s_t = \beta_0 + \beta_1 P^x_t + \beta_2 P^d_t + \beta_3 Y^d_t + \beta_4 M_t$ Exports Supply Function				
	α_0	α_1	α_2	α_3	D_{91}	D_{01}	β_0	β_1	β_2	β_3	β_4
United State	-12.10*	-1.10*	0.67*	2.13*	–	-0.33**	-0.81***	0.02	-0.96	1.71**	-0.46**
	(-10.41)	(-4.35)	(6.70)	(10.4)		(2.5)	(-1.76)	(0.05)	(-0.79)	(2.76)	(-2.42)
	$R^2 = 0.99$	D.W statistics = 1.60					$R^2 = 0.98$	D.W statistics = 1.68			
France	-1.24	-1.21*	0.35*	0.53*	–	–	0.52**	0.63*	1.95*	-0.54*	-0.16
	(-1.43)	(-3.67)	(4.20)	(5.30)			(2.48)	(4.20)	(6.10)	(-3.00)	(-1.60)
	$R^2 = 0.98$	D.W statistics = 1.62					$R^2 = 0.99$	D.W statistics = 1.97			
UK	0.95	-2.17**	1.39**	0.10	–	–	0.29	0.26	-1.63**	1.01**	0.19
	(0.65)	(-2.36)	(2.62)	(0.32)			(0.72)	(0.68)	(-2.12)	(2.73)	(-1.27)
	$R^2 = 0.88$	D.W statistics = 1.82					$R^2 = 0.97$	D.W statistics = 2.50			
Canada	9.71***	-1.58**	0.78	-1.14**	–	–	-0.81**	1.48*	-2.96*	0.68***	0.27**
	(1.80)	(-2.82)	(1.11)	(-2.38)			(-2.70)	(4.84)	(-4.10)	(1.89)	(2.25)
	= 0.97	D.W statistics = 1.47					$R^2 = 0.97$	D.W statistics = 2.32			
Korea	-12.95**	-0.20	1.99**	1.54***	–	–	-3.36**	4.64**	-3.42**	0.87	1.10**
	(-2.10)	(-0.21)	(1.79)	(1.90)			(-2.51)	(2.27)	(-2.25)	(1.24)	(2.56)
	$R^2 = 0.85$	D.W statistics = 1.49					$R^2 = 0.88$	D.W statistics = 2.02			
Kuwait	-2.14*	-0.59***	0.42	0.90*	-0.89**	–	0.22	-1.83**	-0.68	1.69	0.11
	(-3.40)	(-1.69)	(1.24)	(6.24)	(2.38)		(0.26)	(2.76)	(-0.32)	(1.67)	(0.38)
	$R^2 = 0.58$	D.W statistics = 1.98					$R^2 = 0.47$	D.W statistics = 2.04			
Malaysia	-3.46	-1.49	3.10	-0.35	–	–	-2.80*	3.15*	-6.10*	1.71**	0.74**
	(-1.20)	(-0.71)	(1.15)	(-0.27)			(-3.32)	(3.54)	(-3.37)	(2.19)	(2.31)
	$R^2 = 0.91$	D.W statistics = 1.89					$R^2 = 0.85$	D.W statistics = 2.17			
Mauritius	-6.18*	-1.04***	1.03**	2.14*	–	–	-2.35*	2.31**	-5.74*	2.56*	0.31**
	(-5.62)	(-1.96)	(2.34)	(4.86)			(-3.18)	(2.52)	(-3.51)	(4.27)	(1.99)
	$R^2 = 0.78$	D.W statistics = 2.06					$R^2 = 0.75$	D.W statistics = 1.90			
Germany	3.13	-0.86*	-0.32	0.32	–	–	18.75**	-0.21	0.40	-3.45*	0.16
	(1.01)	(-3.74)	(-0.67)	(0.91)			(2.32)	(-0.53)	(0.28)	(2.83)	(0.60)
	$R^2 = 0.97$	D.W statistics = 1.74					$R^2 = 0.95$	D.W statistics = 2.35			
Bangladesh	-4.68*	-0.50	0.01	1.62*	–	–	-3.28*	2.54*	-4.42*	1.03*	1.30*
	(-3.66)	(-1.19)	(0.05)	(4.15)			(9.94)	(6.20)	(5.10)	(3.10)	(11.80)
	$R^2 = 0.81$	D.W statistics = 2.61					$R^2 = 0.84$	D.W statistics = 2.06			
S Arabia	-1.65**	-0.80***	0.49	0.61*	–	–	-2.18*	1.64*	-1.72**	-0.35	0.85**
	(-2.47)	(-1.84)	(1.12)	(4.40)			(-3.34)	(3.28)	(-1.87)	(-0.69)	(2.69)
	$R^2 = 1.91$,	D.W statistics 1.91					$R^2 = 0.59$	D.W Statistics: 1.64			

The numbers in parenthesis are the estimated "t" values of the respective coefficients. (*), (**) and (***) indicate significance at 1, 5 and 10 percent respectively.

[9]The results have not been shown here, but are available from the author on demand.

6.1.1. *Analysis of the Results (GMM)—Demand Side Equation*

The first and important point to note is that the coefficient of the world GDP (GDP of the trading partners) on the demand side carries significant and correct sign in most cases except for UK, Malaysia and Germany where is insignificant. The coefficients on the income elasticity of demand appear with a wide range of values across the countries concerned i.e., the highest coefficient is 2.13 for USA and the lowest is 0.10 for UK. The income elasticity of demand in case of UK and Germany appears with correct sign but it is not significant even at 10 percent.[10]

The own price elasticity of export demand is found to be significant in most cases with correct sign and plausible magnitudes with the exception of a few cases. This parameter also differs in terms of significance and magnitudes across the countries like the income elasticity. The estimated elasticities are insignificant for Korea, Malaysia and Bangladesh. The cross price elasticity of export demand is found to be smaller in magnitude as compared to the price elasticity across all the countries under study. This means that our exports are much sensitive to changes in prices of exports in the world market as compared to the prices of competing or substitute goods at our country export market. Besides the income and price variables, two dummies (D91 and D01) have been introduced in the demand side export equation to examine the impact of Kuwait-Iraq war (1991) and Afghanistan war (2001) on our export behaviour.[11] The Dummy variable "D91" is assigned '0' before 1991 and '1' thereafter while the dummy variable "D01" takes '0' before 2001 and '1' thereafter. The coefficient of dummy "D91" carries significant magnitude and negative sign only in case of Kuwait. This implies that the Kuwait-Iraq war had a negative impact on exports flow of Pakistan to Kuwait. The coefficient of dummy "D91" is insignificant across all other countries although it carries its expected negative sign. The dummy "D01" is found to be negatively signed in almost all cases but turns out to be significant only for the United State. This indicates that the Afghanistan war (2001) has a negative impact on our exports flow to the United States.

6.1.2. *Analysis of the Results (GMM)—Supply Side Equation*

The concerned elasticities have been calculated from the supply function (4.7).[12] The income elasticity of exports supply appears to have correct sign and significant magnitudes for all the countries except France and Germany. This is found to be greater than unity in all cases which indicates that 1 percent increase in national income brings more than 1 percent increase in export supply. The price variables in the supply side equation provide mix results in terms of sign and significance of the variables. The foreign price elasticity of export supply turns out to be significant across all the countries except for US, UK and Germany, although it differs significantly in magnitudes across

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[10]The results on the income elasticities are in accordance to Khan and Night (1978), Muscatelli (1992) and Roy (2002) who find positive and significant income elasticities of demand for exports.

[11]We have not considered the dummies in other equations since they were found to be insignificant. We have re-estimated equations after the omission of the two dummies.

[12]The elasticities of export supply with respect to the variables concerned have been indirectly calculated from the supply function. It may be recalled that we have normalised the export supply function in terms price of exports. The elasticities of the supply side equation have been calculated as follows.

$$\beta_0 = -\frac{\gamma_0}{\gamma_1}, \quad \beta_1 = \frac{1}{\gamma_1}, \quad \beta_2 = -\frac{\gamma_2}{\gamma_1}, \quad \beta_3 = -\frac{\gamma_3}{\gamma_1}, \quad \beta_4 = -\frac{\gamma_4}{\gamma_1}$$

the countries. It appears with unexpected sign for Germany and Kuwait. The own price elasticity of exports supply carries significant and relatively high magnitudes across the countries. This implies that the export supply is much sensitive to changes in domestic prices of exports. The signs are unexpected only in case of France and Germany and the magnitudes are insignificant only for USA and Kuwait.

The import of 'industrial inputs' indicates significant magnitudes with positive signs in most cases with the exception of a few. This means that import of inputs have a positive impact on exports performance.

6.2. Empirical Bayesian Findings

The Empirical Bayesian estimates of the demand and supply functions are given in Table 2 below. The important points are discussed below.

6.2.1. *Analysis of the Results (Empirical Bayes)—Demand Side Equation*

The first column of Table 2, reports the Empirical Bayesian results of the demand side exports equation. This offers very much improvement over the GMM estimates. The foremost point to be noted, here is that the estimated standard errors are much smaller than their GMM counterparts. The improvement in precision is noticeable if we look into the signs of the parameters. All the demand side elasticities appear to be highly significant with correct signs for all the trading partners. This is actually due to the addition of prior information to the model. The magnitudes of the income and price elasticities are smaller than the respective GMM estimates across the countries concerned.

Table 2

Empirical Bayes Results of the Demand and Supply Functions

Trade Partners Coefficients	$X^d_t = \alpha_0 + \alpha_1 P^x_t + \alpha_2 e.P^w_t + \alpha_3 Y^w_3$ Export Demand Function				$X^s_t = \beta_0 + \beta_1 P^x_t + \beta_2 P^d_t + \beta_3 Y^d_t + \beta_4 M_t$ Exports Supply Function				
	α_0	α_1	α_2	α_3	β_0	β_1	β_2	β_3	β_4
Unite State	−3.39*	−0.98*	0.50*	0.90*	−0.49*	0.78*	−0.16	0.33**	0.24*
	(−10.60)	(−9.17)	(10.21)	(16.08)	(−4.02)	(7.38)	(−0.70)	(2.77)	(4.98)
France	−2.17*	−0.98*	0.42**	0.73*	−0.29**	0.76*	0.60*	0.02	0.20*
	(−6.99)	(−8.82)	(9.01)	(14.46)	(−2.70)	(8.61)	(3.16)	(0.24)	(4.45)
UK	−2.49*	−0.97*	0.46*	0.77*	−0.51*	0.78*	−0.26	0.35*	0.24*
	(−7.68)	(−8.29)	(8.17)	(13.47)	(−4.22)	(7.49)	(−1.15)	(3.02)	(5.09)
Canada	−2.63*	−0.98*	0.45*	0.77*	−0.63*	0.89*	−0.40***	0.32**	0.29*
	(−7.92)	(−8.47)	(8.01)	(13.26)	(−5.35)	(8.61)	(−1.78)	(2.77)	(6.21)
Korea	−2.71*	−0.94*	0.45*	0.80*	−0.62*	0.83*	−0.17	0.29**	0.30*
	(−8.14)	(−8.02)	(8.02)	(13.75)	(−4.89)	(7.70)	(−0.74)	(2.47)	(6.05)
Kuwait	−2.56*	−0.92*	0.45*	0.82*	−0.58*	0.80*	−0.14	0.30**	0.29*
	(−8.69)	(−8.16)	(8.04)	(15.89)	(−4.57)	(7.39)	(−0.59)	(2.47)	(5.77)
Malaysia	−2.68*	−0.95*	0.45*	0.79*	−0.64*	0.86*	−0.23	0.31**	0.30*
	(−8.11)	(−8.09)	(7.96)	(13.62)	(−5.11)	(7.96)	(−0.99)	(2.60)	(6.09)
Mauritius	−2.97*	−0.96*	0.46*	0.82*	−0.65*	0.84*	−0.24***	0.36**	0.29*
	(−9.31)	(−8.29)	(8.17)	(14.17)	(−5.13)	(7.83)	(−1.73)	(3.09)	(5.92)
Germany	−2.61*	−0.93*	0.44*	0.78*	−0.59*	0.75*	−0.12	0.24**	0.28*
	(−7.88)	(−8.88)	(7.81)	(13.61)	(−4.65)	(7.19)	(−0.51)	(2.00)	(5.59)
Bangladesh	−2.80*	−0.92*	0.41*	0.81*	−0.94*	0.93*	−0.43***	0.36*	0.47*
	(−8.69)	(−8.08)	(7.63)	(14.11)	(−7.93)	(8.92)	(−1.87)	(3.17)	(10.21)
S. Arabia	−2.47*	−0.94*	0.45*	0.77*	−0.65*	0.86*	−0.23	0.24**	0.31*
	(−8.29)	(−8.26)	(8.02)	(14.29)	(−5.22)	(8.12)	(−1.01)	(2.08)	(6.15)

The numbers in parenthesis are the estimated 't' values of the respective coefficients, while (*), (**) and (***) indicate significance at 1, 5 and 10 percent respectively.

The own price elasticity of export demand is found to be clustered around unity which implies that 1 percent change in the price of exports cause the export demand to change nearly by the same change. The elasticity of export demand with respect to the prices of competing goods is found to be significant with correct sign. It does not differ too much in terms of magnitude across the countries when compared to the GMM estimates (where we found too much fluctuation). It lies in the range of 0.40 and 0.50 across the countries and it is smaller than the own price elasticity of export demand. This implies that export demand is less responsive to changes in the prices of competing goods in the world market as compared to changes in the own price of exports. The income elasticity of export demand has plausible magnitudes and correct signs, and is found to be less than unity for all the countries. This elasticity varies slightly across the countries which is natural. The highest income elasticity of export demand is 0.90 for USA and the smallest is 0.73 for France. For Saudi Arabia, the income elasticity of export demand is 0.77. This is another significant improvement shown by the Empirical Bayesian Estimator over the GMM estimator.

6.2.2. *Analysis of the Results (Empirical Bayes)—Supply Side Equation*

The second column of the Table 2 reports the results of the Empirical Bayesian estimates of the supply side export equation. The price elasticity of export supply with respect to the world prices of exports in case of USA is found to be 0.78 which means that a 10 percent increase in the foreign prices, export flow to United State rises only by 7.8 percent. The highest price elasticity of export supply is found to be 0.93 for Bangladesh followed by 0.89 for Canada whereas the smallest is 0.75 for Germany. The price elasticity of export supply with respect to the domestic prices of exportable goods turns out to be insignificant and carries very small magnitudes for most of the trading partners. This means that the supply of exports is not much sensitive to changes in the domestic prices of exportable goods. Likewise, the income elasticity of export supply carries reasonable magnitudes across the countries but not too high as one would expect. It is smaller in magnitude than the income elasticity of export demand across the countries. This implies that world demand is more significant than the domestic income level in explaining exports behaviour. The income elasticity of export supply is 0.36 for both Mauritius and Bangladesh whereas for USA, it is 0.33 only. As far as the import of input variable is concerned, its coefficient is highly significant even at 1 percent and appears with expected positive and reasonable magnitudes for all the trading partners. The coefficient of this variable does not vary too much across the countries like the GMM estimates and it lies between 0.20 and 0.50. The positive and significant coefficient on this variable confirms the hypothesis that import of inputs leads to improve export performance significantly in long run. Alternatively, its negative impact on export flow is of transitory nature and can be found only in the short run.

6.3. The Composite Elasticities

In this section, we attempt to estimate the composite elasticities or equivalently the elasticities of export demand and supply as a whole. So far we have analysed the determinants of exports at country-wise disaggregated level and we have found different

elasticities across the countries, i.e., the responsiveness of export demand and supply to a change in any one determinant differs among the countries. Thus keeping in view this situation, we can not correctly specify the relative importance of each determinant in export performance. However, the composite elasticities will depict the over all picture of export behaviour and will help in determining the relative importance of each factor in explaining exports behaviour. These are simply the weighted averages of the individual elasticities across the trading partners. The shares of each trading partner in our exports have been interpreted as weights. The weights have been multiplied with concerned elasticities and the sum of these products across the countries has been divided by the sum of weights to get the composite elasticity. More specifically, we have used the following formula to calculate the composite elasticities of export demand and supply.

$$\eta_i = \frac{\sum_j^n W_j * C_j}{\sum_j^n W_j} \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (6.1)$$

Where, 'η_i' is the elasticity of export demand and supply with respect to the 'ith' determinant i.e., price and income etc. 'W_j' is weight or share of the jth trading partner in our exports. 'C' is the elasticity of exports with respect to the ith determinant i.e., price and income etc for the jth country. 'n' is the total number of trading partners, concerned. Equation (6.1) implies that to calculate the composite elasticity of export demand and supply for the ith determinant, the product of weight/share of the jth trading partner in our exports and the individual elasticity of that ith determinant for the trading partner is added across the 'n' trading partners and then divided by the sum of weights/shares. That is;

$$\eta_i = \frac{W_1 * C_1 + W_2 * C_2 + W_3 * C_3 + \ldots\ldots\ldots + W_j * C_i}{\sum_j^n W} \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (6.2)$$

We have obtained the following composite elasticities of the export demand and supply, using the above specification.

Export Demand Function: $X_t^d = -2.85 - 0.96\, P_t^x + 0.46\, P_t^w + 0.82\, Y_t^w$

Export Supply Function: $X_t^s = -0.55 + 0.79\, P_t^x - 0.23\, P_t^d + 0.31\, Y_t^d + 0.26\, M_t$

The composite price elasticity of export demand or equivalently the own price elasticity of export demand carries plausible magnitude, which is 0.96. This implies that a 10 percent increase in price of exports leads the demand for exports to decline by 9.6 percent. Likewise, the cross price elasticity or elasticity of export demand with respect to the price of competing/substitute goods in the world market is only 0.46, which is smaller than the own price elasticity. This means that export demand is much sensitive to changes in the price of exports as compared to the price of competing/substitute goods. The income elasticity of export demand carries relatively high magnitude of 0.82, which means that a 10 percent increase in the world income leads the demand for export to increase by 8.2 percent.

On the supply-side, all the parameters carried meaningful magnitudes but smaller than the demand side elasticities. For instance, the own price elasticity of export supply is 0.79, which is smaller than the own price elasticity of export demand. Likewise, the price elasticity of export supply is only 0.23, which implies that a 10 percent increase in

domestic price of exportable goods leads the export supply to decrease by 2.3 percent only. This indicates that the domestic prices of exportable goods have not that much concern in determining exports supply. The income elasticity of export supply is o.31, whereas the coefficient of import of inputs is 0.26. Once again this confirms the fact that import of inputs (machinery, equipments and raw material etc.) enhances the country potential to export.

7. SUMMARY

Most of the elasticities of the Empirical Bayesian technique have appeared with correct signs and statistically significant. In contrast, the GMM technique provided mix results and some of the parameters appeared with unbelievable signs and insignificant magnitudes across the countries. The price elasticity of export demand appeared to be statistically significant with correct sign in all cases. In most cases it is around unity which means that a 'given percentage change' in the price of exports brings about an equivalent change in export demand. In other words, our exports are unit elastic in own prices.

The cross price elasticity of export demand carried statistically significant magnitude with correct signs for all the trading partners which indicated that export demand is positively related to changes in the price of competing goods at world market. The income elasticity of export demand was also statistically significant with expected sign, indicating that the world income has a positive impact on our export behaviour.

Both of the two dummies i.e. 'D91' and 'D01' in the demand side export equations turned out to be insignificant in most cases although they carried their expected sign. However, these variables were significant and negatively related to our exports only for Kuwait and USA respectively.

The own price elasticity of export supply appeared with correct sign and significant magnitudes except for Bangladesh. The positive and relatively high magnitudes of the price elasticity indicate the sensitivity of our exports to changes in the price level at world market. The price elasticity of exports supply with respect to the domestic price of exportable goods turned out to be insignificant in most cases although it carried the expected sign.

The income elasticity of exports supply was found to be significant across all the countries except for France. This means that GDP has a critical role in explaining exports performance. The import of inputs appeared with correct sign and reasonable magnitudes in all cases, which strongly supports the hypothesis that import of inputs (machinery, equipments and raw material) has a positive and significant impact on export performance.

As we have already described that the Empirical Bayesian technique is an efficient and attractive devise which allow getting consistent and precise estimates. We have used the Empirical Bayesian technique to estimate the demand and supply functions. This has shown considerable improvement over the GMM results although it is not widely used by this research motivates the researchers to use it wherever it is applicable.

8. CONCLUSIONS

Our main objective was to determine the relative importance of the demand and supply side determinants of exports. The findings establish the importance of demand side factors in explaining export performance as indicated by highly significant magnitudes of the demand side price and income elasticities. The positive and significant coefficient of the world demand can be interpreted as that the Pakistani exporters have achieved up to some extent, the skills and capabilities to meet the global demand for the sophisticated products, i.e. the cotton manufactures like ready made garments and synthetic textiles etc. In addition, the significance of the price of exports on the supply side implies that the price incentives have sufficient concern for the domestic producers to increase supply. A significant finding of the study is the relatively high magnitude of the own price of exports on the demand side. This suggests depreciation of the domestic currency, which makes domestic goods cheaper in the world market relative to the substitute/competing goods to capture the world demand. Still another important finding is the positive and significant coefficient of import of inputs, which confirms the fact that import of inputs is critical for production of goods meant for exports. This strongly rejects the import compression policy, specifically for import of machinery, equipment and raw material etc.

The high income and price elasticity of demand indicates a high demand from the countries in European Union and NAFTA region. That's why Pakistan has persistently concentrated in these markets, although our exports have been seriously affected due to the war on terror.

9. POLICY IMPLICATIONS/RECOMMENDATION

It is evident that commodity composition of the Pakistan's exports has changed significantly over the study period with an increase in the share of manufactures and a fall in the share of primary goods which is a healthy sign. No single factor or determinant can therefore explain this long run changing behaviour of exports. In other words, a number of demand and supply side factors have a significant role in explaining the long run behaviour of exports, most important being the 'price measures' and the 'world demand'. This means that more consideration should be given to demand side determinants as compared to relying purely on the removal of supply-side constraints while devising a viable strategy towards exports growth.

Further is the question of effectiveness of the relative prices (prices of exports relative to the domestic prices of exportable goods) and the world demand. The findings reveal that the world demand i.e., income level of the trading partners is much significant in explaining exports performance as compared to other factors. Although the world demand has grown over the period but due to the poor market access and other restrictions, the growth in exports has not yet matched with this trend. Thus for a sustainable export growth, better market access has to be ensured in addition to diversification.

On the other hand the supply side determinants are relatively not that much important in explaining export performance. This leaves enough room to enhance the share of the value-added goods along with technology up-gradation. In particular, the import of industrial inputs should be facilitated as they provide the very basis for our exports.

The desirable strategy should be diversification of export market with emphasis on the NAFTA, EU and Middle East regions where the demand for Pakistani exports is sufficiently large. The study also recommends particular concentration on the African countries, keeping in view the increasing demand from these countries.

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