©The Pakistan Development Review
50:3 (Autumn 2011) pp. 245–256

# The Role of Global Economic Growth in Pakistani Agri-Food Exports

ZAHOOR UL HAQ, MOHAMED GHEBLAWI, and SAFDAR MUHAMMAD

This analysis uses least squares and Heckman maximum likelihood estimation procedures with fixed effects to explore the role of economic growth in 36 developed and developing economies—categorised as low-, lower-middle-, upper-middle-, and high-income—in explaining their agri-food import of 29 products from Pakistan during 1990 to 2000. We reject the hypothesis that the economic growth of these economies does not influence Pakistani agri-food product exports. However, the estimated income elasticities are statistically elastic only for lower-middle income countries, suggesting that their expenditure on Pakistani agri-food exports will increase disproportionately as their economies grow. Hence, lower-middle-income countries provide good export opportunities for Pakistan's agri-food products.

*JEL Classifications:* F14, Q17
*Keywords:* Economic Growth, Agri-food Trade, Income Elasticities, Developing Countries

## 1. INTRODUCTION

The agriculture sector is still the largest sector of Pakistan's economy despite structural shifts towards industrialisation. The sector accounted for 26 percent of gross domestic product (GDP) in 2000, but gradually shrank to 21 percent in 2007. It employed 44 percent of the total employed labour force in 2007, and is the mainstay of the rural economy around which socioeconomic privileges and deprivations revolve [Pakistan (2009)]. The agriculture sector consists of the crops, livestock, fishing, and forestry subsectors, with the crop subsector further divided into major crops consisting of wheat, cotton, rice, sugarcane, maize, and gram, and minor crops consisting of pulses, potatoes, onions, chillies, and garlic. Historically, the crops subsector accounted for the bulk of the agricultural portion of GDP but its share has been declining since 2000, accounting for 48 percent—a little more than the livestock subsector (47 percent). By 2007, the contribution of the crops subsector had declined to 45 percent while the livestock subsector had increased its share to 52 percent. Since 2000, trade (i.e., the sum of exports and imports) has accounted for about one third of the country's real gross national product (GNP), and agricultural trade for 80 percent of total trade. Hence, the performance of the agriculture sector affects the performance of the country's entire economy.

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Pakistani exports are highly concentrated among a few countries and consist of a small number of commodities; consequently, they are vulnerable to external shocks. The major markets for Pakistani exports are the US, the UK, Germany, Hong Kong, and the United Arab Emirates (UAE). Exports to the US accounted for 20 percent, Hong Kong (24 percent), UK (13 percent), Japan (13 percent), and Germany (7 percent) in 2007. Such a high concentration of exports to a few destinations raises the question whether there is any opportunity for Pakistani agri-food exports to other developing and developed countries. This question becomes more important as developing countries outperform developed countries in economic growth and we need to know whether Pakistani exports benefit from this disproportionate global economic growth. It is also important to mention that, due to their rising income, developing countries' share of agri-food trade has increased. They import half of the agricultural products produced by developed countries and export 61 percent of their agricultural products to the latter. Similarly, developing countries as a group are the second-largest traders with the European Union, with exports of $162 billion and imports of $128 billion of agricultural products in 2000-2001 [Aksoy and Beghin (2005)].

This study investigates the role of income in agri-food exports from Pakistan by estimating the income elasticities of developed and developing countries for these exports. The study tests a number of specific hypotheses about the estimated income elasticities. We hypothesise that (i) the income of developed and developing countries does not determine the import of agri-food products from Pakistan, (ii) the income of developing countries does not determine their import of agri-food products from Pakistan, (iii) the demand for Pakistan's exports of agri-food products is statistically elastic in the importing countries, and (iv) the income elasticities of Pakistani agri-food products are the same for developed and developing countries. The results of these tests will also help to understand the heterogeneity of preferences for the country's exports to other developed and developing countries.

The article is organised into five sections. The next section presents theoretical and empirical models. The third section describes the data used in the analysis, followed by a discussion of results in Section 4 and conclusions in Section 5.

## 2. THEORETICAL AND EMPIRICAL MODELS

We use the theoretical and empirical frameworks developed by Hallak (2006) and modified by Haq and Meilke (2007, 2008, 2010). The framework assumes that demand in each country $i$ is generated by a representative consumer with a two-tier utility function. The upper-tier utility function is weakly separable in sub-utility indices defined over differentiated goods $X_f$ where $f = 1,\ldots, F$ and for each homogenous product $X_h$ where $h = F+1,\ldots, H$. The sub-utility index $u_f^i$ is assumed to have a constant elasticity of substitution (CES) utility function. Maximising the CES approximation of preferences subject to the expenditure on imports generates demand functions for each variety of product $f$. It is further assumed that importing country $i$ consumes different varieties in sector $f$, of the same quality and price. Hence, the value of the bilateral trade flow of country $i$'s imports from country $j$ in sector $f$ in year $y$ ($imp_{ijfy}$) is given as

$$imp_{ijfy} = \frac{\left(p_{jfy}\,\tau_{jfy}\right)^{1-\sigma_f} \bar{I}_{iy}}{\sum_{f=1}^{F}\left(p_{jfy}\tau_{jfy}\right)^{1-\sigma_f}} \quad \ldots \quad \ldots \quad \ldots (1)$$

where $\sigma_f$ is the elasticity of substitution between any two products within a sector faced by a consumer in country $i$; $\tau_{ijfy}$ is the trade associated cost between countries $i$ and $j$ for product $f$; $P_{jfy}$ represents the price of each variety $f$ in country $j$ in year $y$; $P_{jfy}\ \tau_{ijfy}$ represent the trade cost-adjusted price of the product $f$; $\sum_{f=1}^{F}(P_{jfy}\tau_{ijfy})^{1-\sigma_f}$ represents the price index of all the varieties and $\bar{I}_{iy}$ is the average per capita income of country $i$, and represents the expenditures made on any sector $f$ in country $i$ since no expenditure data is available.

We assume that trade costs ($\tau_{ijfy}$) are determined by distance (dist), trade partners sharing a common border (DCB), landlocked countries (Landl), island countries (Island), a common language (DComlang), bilateral trade partners colonising each other (DColony), and trade protocol among developing countries (DPTN).[1] This relationship is given in Equation (2) and based on the insights from previous studies [Hallak (2006)].

$$ln\tau_{ijfy} = \beta_1 lndist_{ij} + \beta_2 DCB_{ij} + \beta_3 landl_i + \beta_4 Island_i + \beta_5 DComlang_{ij} + \beta_6 DColony_{ij} + \beta_7 DPTN_{ij} + v_{ij} \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (2)$$

Taking the logarithm of both sides of Equation (1) and substituting for transaction cost ($\tau_{ijfy}$) in Equation (1), we obtain the following equation for the value of imports:

$$\ln imp_{ijfy} = (1-\sigma_f)\ln P_{jfy} - (1-\sigma_f)\ln \sum_{f=1}^{F} P_{ify} + (1-\sigma_f)\beta_1 \ln dist_{ij} + (1-\sigma_f)\beta_2 DCB_{ij} + (1-\sigma_f)\beta_3 Landl_i + (1-\sigma_f)\beta_4 Island_i + (1-\sigma_f)\beta_5 DComlang_{ij} + (1-\sigma_f)\beta_6 DColony_{ij} + (1-\sigma_f)\beta_7 DPTN_{ij} + \beta_8 \ln\bar{I}_i + \varepsilon^j_{if} \quad \ldots \quad \ldots \quad (3)$$

where $\varepsilon^j_{if} = (1-\sigma_f)V^j_{if}$. In Equation (3), $P_{jfy}$ is captured by exporter fixed effects; however, since only Pakistan's exports are being considered, these fixed effects are not required. The variable $\sum_{f=1}^{F} P_{ify}$ represents importing country-specific effects, and importing country fixed effects $(\psi_i)$ capture these effects. These importing country-specific fixed effects also allow us to control other unobserved factors such as product quality characteristics and technical and non-technical barriers. The analysis covers 29 agri-food products over 11 years, therefore product- ($\psi_f$) and year ($\psi_y$)-specific fixed effects are also added to Equation (3) to account for the product and time dimensions. Let $(1-\sigma_f)\beta_1 = \gamma_1$, $(1-\sigma_f)\beta_2 = \gamma_2$, $(1-\sigma_f)\beta_3 = \gamma_3$, $(1-\sigma_f)\beta_4 = \gamma_4$, $(1-\sigma_f)\beta_5 = \gamma_5$, $(1-\sigma_f)\beta_6 = \gamma_6$, $(1-\sigma_f)\beta_7 = \gamma_7$ and $\beta_8 = \gamma_8$ so that Equation (3) can be rewritten, including the fixed effects as:

$$\ln imp_{ijfy} = \psi_i + \psi_y + \psi_f + \gamma_1 \ln dist_{ij} + \gamma_2 DCB_{ij} + \gamma_3 Landl_i + \gamma_4 Island_i + \gamma_5 DComlang_{ij} + \gamma_6 DColony_{ij} + \beta_7 DPTN_{ij} + \gamma_8 \ln\bar{I}_{iy} + \varepsilon_{ijfy} \quad \ldots \quad \ldots \quad (4)$$

[1]Factors affecting the tariff structure between trade partners, such as preferential trade agreements, are not included because Pakistan does not have such arrangements with the countries in the sample for the years 1990-2000.

Since the study tests a number of hypotheses that require product-specific income elasticities for low-, lower-middle-, upper-middle-, and high-income countries, the per capita income variable in Equation 4 is split into $\bar{I}^i_{LIy}, \bar{I}^i_{LMIy}, \bar{I}^i_{UMIy}$ and $\bar{I}^i_{HIy}$ representing the per capita income of low-income, lower-middle-income, upper-middle-income, and high-income countries, respectively, thereby allowing for different income elasticities. Per capita income ($\bar{I}_{iy}$) is interacted with dummy variables representing the level of economic development to obtain income elasticities for low-, lower-middle-, upper-middle-, and high-income countries as follows:

$$\begin{aligned}
\bar{I}^i_{LIy} &= \bar{I}_{iy} * D^i_{LI} \\
\bar{I}^i_{LMIy} &= \bar{I}_{iy} * D^i_{LMI} \\
\bar{I}^i_{UMIy} &= \bar{I}_{iy} * D^i_{UMI} \\
\bar{I}^i_{HIy} &= \bar{I}_{iy} * D^i_{HI}
\end{aligned} \qquad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (5)$$

where $D^i_{LI}$, $D^i_{LMI}$, $D^i_{UMI}$ and $D^i_{HI}$ are dummies that represent the development level of importing countries: $D^i_{LI}$ is 1 for low-income countries and 0 otherwise, $D^i_{LMI}$ is 1 for lower-middle-income countries and 0 otherwise, $D^i_{MI}$ is 1 for upper-middle-income countries and 0 otherwise, and $D^i_{HI}$ is 1 for high-income countries and 0 otherwise. Equation (4) is augmented by the income shifters and reproduced below as Equation (6):

$$\begin{aligned}
\ln imp_{ijky} &= \psi_i + \psi_y + \psi_f + \gamma_1 \ln dist_{ij} + \gamma_2 DCB_{ij} + \gamma_3 Landl_{ij} + \gamma_4 Island_{ij} + \\
&\gamma_5 DCom lang_{ij} + \gamma_6 DCol ony_{ij} + \gamma_7 DPTN_{ij} + \gamma_{8LI} \ln \bar{I}^i_{LIy} + \gamma_{9LMI} \ln \bar{I}^i_{LMIy} + \\
&\gamma_{10UMI} \ln \bar{I}^i_{UMIy} + \gamma_{11HI} \ln \bar{I}^i_{HIy} + \varepsilon_{ijky}
\end{aligned} \qquad \ldots \quad \ldots \quad (6)$$

Equation 6 is used to test our proposed hypotheses and estimated using ordinary least squares (OLS) and the Heckman maximum likelihood (ML) procedure. The choice of the Heckman selection procedure is motivated by zero-trade flows in the data. Omitting these zeros from the analysis could lead to selection bias [Heckman (1979)]. The Heckman selection procedure corrects the selection bias by including the inverse Mills ratio (IMR) in the regression model. Omission of the IMR from the regression model, when it is statistically significant, leads to an omitted variable bias [Heckman (1979)].

The Heckman selection procedure consists of selection and outcome equations. The selection equation is specified as probit and the outcome equation as the least squares regression equation. Both equations are simultaneously estimated using the ML procedure. The Heckman model can also be estimated in two steps, but we have chosen to use the ML procedure because it estimates homoscedastic standard errors [Greene (2003)]. This is important in the context of this study since we are using cross-sectional data. In the case of the Heckman selection model, the specification of the selection equation is motivated by the earlier studies of Linder and de Groot (2006), Bikker and De Vos (1992), and Hillberry (2002). Finally, the Heckman ML procedure does not directly estimate the IMR but estimates rho and sigma, calculating the arc hyperbolic tangent of

rho and the natural logarithm of sigma, and then including these variables in the regression model to control for the selection bias.

## 3. DATA

The study uses trade data from the World Trade Analyzer (WTA) covering trade flows from 1990 to 2000[2] [Statistics Canada (2004)]. The data is organised by the Standard International Trade Classification (SITC), revision 3, at the four-digit level. The agri-food products included in the study are given in Table 1. The countries included in the analysis are given in Table 2. These countries are categorised as lower-income (LI), lower-middle-income (LMI), upper-middle-income (UMI), and high-income (HI), using World's Bank per capita GNP thresholds. The data on GDP and per capita GDP is from the World Bank's World Development Indicators. Estimates of the distance between capitals and border sharing are obtained from the World Bank's website [World Bank (2007)]. The data required for the other gravity variables in the trade model has been compiled from Glick and Rose (2002).

Table 1

*List of Selected Agri-Food Products at Four-Digit SITC Level*

| No. | SITC Description | Number of Cases | Percent |
|---|---|---|---|
| 1 | Apples, fresh | 55 | 1.48 |
| 2 | Beans, peas, lentils and other leguminous | 209 | 5.64 |
| 3 | Cereal grains, worked/prepared | 55 | 1.48 |
| 4 | Chocolate and other food preparations | 220 | 5.93 |
| 5 | Crustaceans and molluscs, fresh, chilled | 319 | 8.61 |
| 6 | Crustaceans and molluscs, prepared or preserved | 55 | 1.48 |
| 7 | Edible nuts (excluding nuts used for extraction) | 176 | 4.75 |
| 8 | Edible products and preparations | 308 | 8.31 |
| 9 | Fish fillets, fresh or chilled | 55 | 1.48 |
| 10 | Fish, dried, salted or in brine; smoked | 121 | 3.26 |
| 11 | Fish, fresh (live/dead) or chilled | 187 | 5.04 |
| 12 | Fish, prepared or preserved | 110 | 2.97 |
| 13 | Fruit otherwise prepared or preserved | 22 | 0.59 |
| 14 | Fruit, fresh or dried | 352 | 9.5 |
| 15 | Fruit, temporarily preserved | 33 | 0.89 |
| 16 | Grapes, fresh or dried | 110 | 2.97 |
| 17 | Jams, fruit jellies, marmalades | 77 | 2.08 |
| 18 | Juices; fruit and vegetable | 176 | 4.75 |
| 19 | Malt extract; preparation of flour | 33 | 0.89 |
| 20 | Meat of bovine animals, fresh, chilled | 44 | 1.19 |
| 21 | Oranges, mandarins, clementines, and other | 209 | 5.64 |
| 22 | Other citrus fruit, fresh or dried | 66 | 1.78 |
| 23 | Other fresh or chilled vegetables | 198 | 5.34 |
| 24 | Other prepared or preserved meat | 22 | 0.59 |
| 25 | Potatoes, fresh or chilled | 66 | 1.78 |
| 26 | Tea | 33 | 0.89 |
| 27 | Vegetables, dried dehydrated or evaporated | 154 | 4.15 |
| 28 | Vegetables, frozen or in temporary preserved | 22 | 0.59 |
| 29 | Vegetables, prepared or preserved | 143 | 3.86 |
| | Total | 3,707 | 100 |

[2]Although, this study uses data from 1990 to 2000, more recent data shows that the structure of trade has not changed much since 2000. In 2007, Pakistan exported about 64 percent of its agricultural products to high-income countries, 19 percent to low-income countries, 12 percent to lower-middle-income countries, and 5 percent to upper-middle-income countries.

Table 2

*Average Real GDP, Population, and Real per Capita GDP of Selected Countries for 1990–2000*

| No. | Country | Income Level | Real GDP (Million $) | Population (Million) | Real per Capita GDP* ($) |
|---|---|---|---|---|---|
| 1 | Bangladesh | Low income | 35,957 | 116.4 | 307.1 |
| 2 | Brazil | Lower-middle income | 528,485 | 161.5 | 3,265.5 |
| 3 | Canada | High income: OECD | 593,278 | 29.4 | 20,165.8 |
| 4 | China | Lower-middle income | 798,284 | 1202.9 | 657.6 |
| 5 | Colombia | Lower-middle income | 76,981 | 38.5 | 1,994.3 |
| 6 | Denmark | High income: OECD | 139,319 | 5.2 | 26,587.4 |
| 7 | Egypt | Lower-middle income | 80,270 | 61.3 | 1,301.9 |
| 8 | Ethiopia | Low income | 5,285 | 57.3 | 91.9 |
| 9 | Finland | High income: OECD | 100,593 | 5.1 | 19,722.5 |
| 10 | France | High income: OECD | 1,168,904 | 57.8 | 20,202.6 |
| 11 | Germany | High income: OECD | 1,720,911 | 81.3 | 21,148.1 |
| 12 | India | Low income | 350,419 | 932.5 | 373.1 |
| 13 | Indonesia | Lower-middle income | 148,019 | 192.6 | 765.8 |
| 14 | Ireland | High income: OECD | 64,168 | 3.6 | 17,588.6 |
| 15 | Italy | High income: OECD | 980,106 | 57.2 | 17,121.4 |
| 16 | Japan | High income: OECD | 4,470,770 | 125.3 | 35,667.3 |
| 17 | Jordan | Lower-middle income | 6,952 | 4.1 | 1,670.2 |
| 18 | Madagascar | Low income | 3,341 | 14.0 | 239.0 |
| 19 | Mexico | Upper-middle income | 480,735 | 90.8 | 5,279.8 |
| 20 | Netherlands | High income: OECD | 315,712 | 15.4 | 20,415.5 |
| 21 | Norway | High income: OECD | 141,007 | 4.4 | 32,277.0 |
| 22 | Peru | Lower-middle income | 44,866 | 23.8 | 1,872.3 |
| 23 | Philippines | Lower-middle income | 63,697 | 68.4 | 928.8 |
| 24 | Poland | Upper-middle income | 133,350 | 38.5 | 3,461.3 |
| 25 | Portugal | High income: OECD | 91,093 | 10.0 | 9,063.9 |
| 26 | Romania | Lower-middle income | 38,072 | 22.7 | 1,675.4 |
| 27 | South Africa | Upper-middle income | 117,730 | 39.3 | 2,995.5 |
| 28 | Spain | High income: OECD | 494,511 | 39.4 | 12,526.3 |
| 29 | Sri Lanka | Lower-middle income | 12,823 | 18.1 | 703.8 |
| 30 | Sweden | High income: OECD | 207,236 | 8.8 | 23,624.3 |
| 31 | Switzerland | High income: OECD | 226,814 | 7.0 | 32,415.9 |
| 32 | Tanzania | Low income | 7,662 | 30.7 | 249.4 |
| 33 | Thailand | Lower-middle income | 108,525 | 58.2 | 1,858.1 |
| 34 | Turkey | Upper-middle income | 168,673 | 61.8 | 2,721.7 |
| 35 | United Kingdom | High income: OECD | 1,243,523 | 58.3 | 21,307.0 |
| 36 | United States | High income: OECD | 8,155,109 | 266.1 | 30,558.2 |
| | All Countries | | 647,866.1 | 111.3 | 10,911.2 |

*In 2000 $.

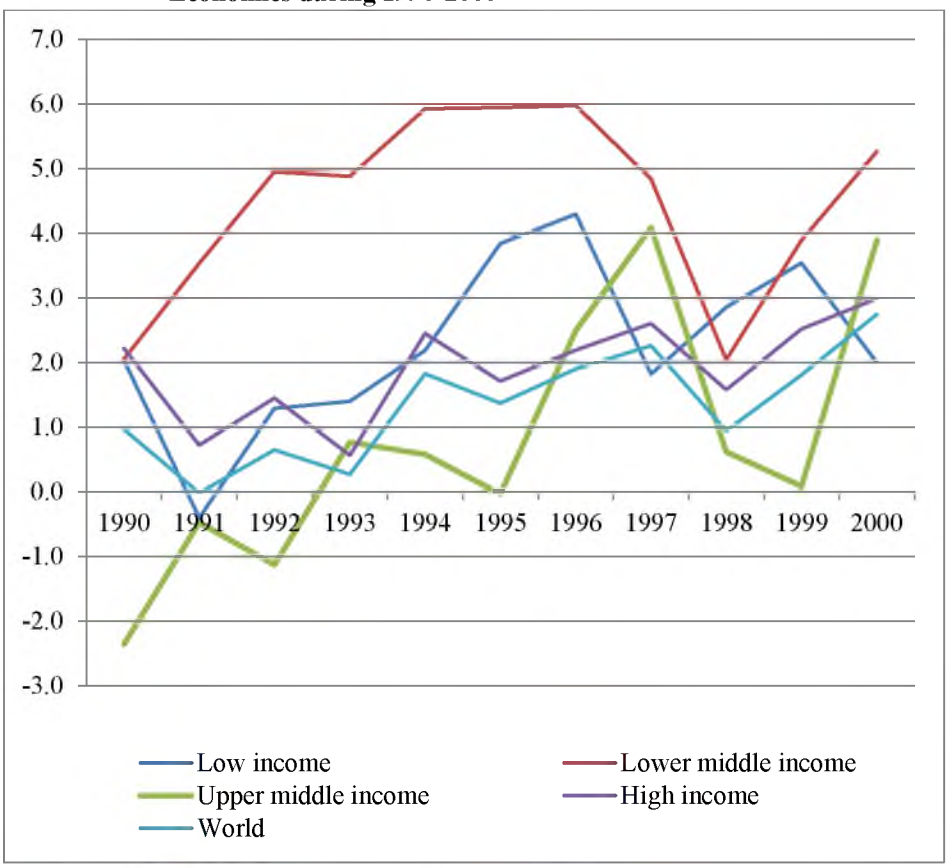
## 4. RESULTS AND DISCUSSION

However, before discussing the estimated results, it is important to provide an overview of the per capita GDP, population, GDP, per capita GDP growth of the selected countries, and structure of trade between Pakistan and low-, lower-middle-, upper-

middle-, and high-income economies. The selected countries cover a wide range of importing countries, with real per capita incomes ranging from $92 for Ethiopia to $35,667 for Japan, with an average per capita income of $10,911 during 1990-2000 (Table 2). Similarly, the average population of the selected countries ranges from 3.6 million in Ireland to 1,203 million in China. The inclusion of countries with such diverse economic characteristics helps explain the structure of agri-food trade.

During 1990-2000, the nominal per capita GDP in the world grew at 1.3 percent (Figure 1): lower-middle-income economies accounted for the highest average nominal per capita GDP growth of 4.5 percent, followed by low-income (2.3 percent), high-income (1.9 percent), and upper-middle-income (0.8 percent) countries. However, Figure 1 also shows that growth in high-income economies was more stable than in others. It is also important and relevant that, although the growth in high-income economies was lower than in other economies, the absolute increase in the former's GDP was greater than that in middle-income economies, given that the high-income countries had larger economies.

**Fig. 1. Nominal per Capita GDP Growth in the World: Low-Income, Lower-Middle-Income, Upper-Middle-Income, and High-Income Economies during 1990-2000**




*Source*: World Bank Economic Indicators [World Bank (2008)].

Table 3 shows the total value of Pakistan's agri-food exports to low-, lower-middle-, upper-middle-, and high-income economies. On average, Pakistan's agri-food exports were valued at $154.3 million per year during 1990-2000. More than 66 percent of these exports were to high-income economies, followed by 18 percent to lower-middle-income and 14 percent to low-income economies. Upper-middle economies imported, on average, only 1 percent of agri-food exports per year from Pakistan during this period, but these exports showed higher growth (24.4 percent) than those of other economies. Overall, while the data shows a high degree of export concentration in high-income economies, there was higher export growth in the middle-income economies. Also, export growth was more stable in the developing economies (2 percent) than in high-income (7.9 percent) economies, as shown by the coefficient of variation.[3]

Table 3

*Total Value of Pakistani Agri-Food Exports to Low-, Lower-Middle-, Upper-Middle-, and High-Income Economies during 1990 to 2000 (Million $)*

| Year | Low-Income | Lower-Middle Income | Upper-Middle Income | High-Income | Total |
|---|---|---|---|---|---|
| 1990 | 19.1 (14.4) | 14.6 (11.0) | 1.1 (0.8) | 97.9 (73.8) | 132.6 |
| 1991 | 10.5 (8.6) | 21.5 (17.7) | 1.1 (0.9) | 88.1 (72.7) | 121.1 |
| 1992 | 18.2 (14.5) | 17.8 (14.2) | 0.5 (0.4) | 88.7 (70.8) | 125.2 |
| 1993 | 20.3 (14.0) | 17.0 (11.7) | 0.8 (0.6) | 107.2 (73.8) | 145.3 |
| 1994 | 18.2 (12.9) | 16.2 (11.5) | 1.7 (1.2) | 105.2 (74.5) | 141.2 |
| 1995 | 18.5 (13.0) | 15.2 (10.7) | 1.9 (1.3) | 106.3 (75.0) | 141.9 |
| 1996 | 28.6 (17.3) | 26.3 (15.9) | 1.4 (0.8) | 109.4 (66.0) | 165.8 |
| 1997 | 26.1 (13.7) | 29.2 (15.3) | 2.1 (1.1) | 133.5 (69.9) | 191.0 |
| 1998 | 25.9 (15.4) | 45.1 (26.9) | 4.1 (2.4) | 92.8 (55.3) | 167.8 |
| 1999 | 24.2 (13.8) | 57.1 (32.7) | 4.7 (2.7) | 88.8 (50.8) | 174.8 |
| 2000 | 34.7 (18.2) | 45.3 (23.8) | 4.1 (2.2) | 106.2 (55.8) | 190.3 |
| Average | 22.2 (14.4) | 27.8 (18.0) | 2.1 (1.4) | 102.2 (66.2) | 154.3 |
| | | | Growth/decay | | |
| 1990-91 | –45.2 | 47.4 | 6.4 | –10.0 | –8.7 |
| 1991-92 | 73.4 | –16.9 | –52.5 | 0.7 | 3.4 |
| 1992-93 | 11.7 | –4.8 | 55.6 | 20.9 | 16.1 |
| 1993-94 | –10.4 | –4.4 | 100.2 | –1.9 | –2.8 |
| 1994-95 | 1.6 | –6.4 | 11.0 | 1.1 | 0.5 |
| 1995-96 | 55.2 | 73.3 | –26.0 | 2.9 | 16.8 |
| 1996-97 | –9.0 | 10.9 | 55.9 | 22.0 | 15.2 |
| 1997-98 | –0.6 | 54.4 | 90.6 | –30.5 | –12.1 |
| 1998-99 | –6.7 | 26.7 | 14.3 | –4.3 | 4.2 |
| 1999-2000 | 43.6 | –20.8 | –11.3 | 19.6 | 8.9 |
| 1990-2000 | 81.7 | 210.9 | 289.8 | 8.5 | 43.5 |
| Average | 17.8 | 15.9 | 24.4 | 2.0 | 4.1 |
| CV | 2.01 | 2.06 | 2.04 | 7.86 | 2.47 |

*Source:* Authors' calculations from data.
Figures in parentheses show percentage of total value of trade within a given year.

[3]The coefficient of variation (CV) is a normalised measure of the dispersion of a probability distribution and is defined as the ratio of the standard deviation to the mean.

The estimated results are compiled in Table 4, while the hypotheses are tested in Table 5. Table 4 shows that importing country-specific effects and commodity fixed effects are statistically significant across all the procedures while time (year) fixed effects are statistically significant only for the Heckman ML procedure. Hence, omitting these fixed effects from the estimated equation would have produced biased estimates. The F-statistics yielded through OLS and the Wald test in the case of the Heckman ML procedure test the hypothesis that all the coefficients in the regression model (except the intercept) are zero. This hypothesis is consistently rejected at a 99 percent level of significance for all the procedures, indicating that the explanatory variables are collectively statistically significant in determining the per capita bilateral trade flows of Pakistani agri-food exports. The explanatory power of the model estimated using OLS shows that 49 percent of the variation in the dependent variable is explained by variations in the independent variables.

Table 4

*Heteroscedasticity-Corrected Regression Results for Agri-Food Exports (Real 2000 Dollars) Using OLS and Heckman ML Procedures*

| | OLS | | | Heckman ML Procedure | | |
|---|---|---|---|---|---|---|
| Variable | Estimate | SE[A] | p-value | Estimate | SE | p-value |
| Log of Distance | –6.080 | 3.583 | 0.090 | –11.939 | 4.279 | 0.005 |
| Common Border | 0.044 | 1.669 | 0.979 | 4.247 | 2.161 | 0.149 |
| **Expenditure Elasticity of:** | | | | | | |
| Lower-Income Countries | –0.331 | 1.219 | 0.786 | –0.136 | 1.235 | 0.912 |
| Lower-Middle-Income Countries | 1.995 | 0.712 | 0.005 | 4.146 | 0.896 | 0.000 |
| Upper-Middle-Income Countries | –1.089 | 0.747 | 0.145 | –0.069 | 0.032 | 0.031 |
| High-Income Countries | 0.186 | 0.642 | 0.773 | –0.556 | 0.764 | 0.467 |
| Landlocked | –2.224 | 3.048 | 0.466 | –5.582 | 3.581 | 0.119 |
| Island | –0.629 | 0.478 | 0.188 | 0.334 | 0.598 | 0.576 |
| Common Colonizer | 10.517 | 6.209 | 0.091 | 29.254 | 8.027 | 0.000 |
| Colony | 5.093 | 3.325 | 0.126 | 15.922 | 4.337 | 0.000 |
| Common Language | –4.720 | 3.692 | 0.201 | –13.916 | 4.585 | 0.002 |
| Protocol on Trade among Developed Countries | –4.530 | 5.472 | 0.408 | –14.391 | 6.557 | 0.128 |
| Arc Hyperbolic Tangent of rho | – | – | – | 1.594 | 0.524 | 0.002 |
| Log (sigma) | – | – | – | 0.838 | 0.117 | 0.000 |
| **Fixed Effects** | | | | | | |
| Importing Country | 18.0 | | 0.000 | 45.8 | | 0.000 |
| Year | 0.7 | | 0.728 | 41.1 | | 0.004 |
| Commodity | 26.1 | | 0.000 | 82.1 | | 0.000 |
| **Summary Statistics** | | | | | | |
| Uncensored Observations | 1531 | | | 1531 | | |
| Total Number of Observations | – | | | 3707 | | |
| F-Statistics | 18.8 | | 0.000 | 1345.2[B] | | 0.000 |
| R-squared | 0.49 | | | – | | |

[A] All standard errors are robust.
[B] Represent Chi test statistics.

Table 5

*Test of Hypotheses Using OLS and Heckman ML Procedures*

| No. | Hypothesis | OLS | | Heckman ML | |
|---|---|---|---|---|---|
| | | F-Statistics | p-value | Chi-Test | p-value |
| 1 | Agri-food imports of low-income countries from Pakistan are statistically different from 1 | 1.3 | 0.264 | 1.2 | 0.275 |
| 2 | Agri-food imports of lower-middle-income countries from Pakistan are statistically different from 1 | 2.1 | 0.152 | 2.0 | 0.162 |
| 3 | Agri-food imports of upper-middle-income countries from Pakistan are statistically different from 1 | 8.2 | 0.004 | 7.8 | 0.005 |
| 4 | Agri-food imports of high-income countries from Pakistan are statistically different from 1 | 1.7 | 0.194 | 1.6 | 0.205 |
| 5 | The effect of developed and developing countries' income elasticities on trade is 0 | 2.8 | 0.026 | 2.0 | 0.162 |
| 6 | The effect of developing countries' income elasticities on trade is 0 | 3.7 | 0.012 | 7.8 | 0.005 |

The estimated models included variables such as distance, trade partners sharing a common border, landlocked countries, island countries, common language, trade partners that have colonized each other, trade partners colonised by the same coloniser, and protocol on trade among developing countries. It is expected that an increase in distance between trading partners leads to a fall in trade while countries adjacent to each other, i.e., with a common border, trade more. Similarly, landlocked and island countries are expected to trade less while countries colonised by a common coloniser, with a common language, border, and colonial history are expected to trade more. Table 4 shows that the effect of distance on Pakistani agri-food exports is negative and statistically significant. The effect of common borders on Pakistani exports is statistically insignificant, which could be because, with the exception of China, Pakistan does not export intensively to its neighbours India, Afghanistan, Bangladesh, and Iran. The effects of other variables on exports are as expected when statistically significant. The direction of the effects of variables across the estimation procedures is consistent but the magnitudes of the estimated parameters are not directly comparable since the Heckman selection procedure does not directly yield marginal effects. Marginal effects can be generated for the Heckman selection model, but this is beyond the scope of this paper.

### 4.1. Does Global Economic Growth Affect Pakistan's Agri-Food Trade?

The role of income in explaining the trade of differentiated agri-food products is explored by estimating the income elasticities of low-, lower-middle-, upper-middle-, and higher-income countries, and then testing specific hypotheses concerning the role of these income elasticities. Our analysis considers all commodities collectively and does not draw separate conclusions for different product sectors. The results imply that we can accept the hypothesis that income elasticities are different from 1 for low-income, lower-middle-income, and high-income countries when using either the OLS or Heckman procedures, but not for upper-middle-income countries. Interpreting the results of these hypotheses and income elasticities given in Table 4 suggests that, in the case of lower-

middle-income economies, the proportionate increase in their per capita income leads to a more-than-proportionate increase in their exports from Pakistan. The premise that developing countries' incomes do not determine trade is rejected when using both procedures (Table 5).

The individual significance of income elasticities (Table 4) for Pakistani exports shows that low- and high-income countries' incomes do not significantly determine Pakistani exports, when using either the OLS or Heckman procedures. The income elasticity of upper-middle-income countries is statistically insignificant when estimated by OLS but statistically significant when using the Heckman procedure. Hence, the choice of estimation procedure can change the results of the hypothesis testing. However, in the case of upper-middle-income economies, income elasticity estimated using the Heckman procedure is negative, indicating that the growth in per capita income of upper-middle-income countries leads to a decrease in their demand for Pakistani exports. Lower-middle-income countries' estimated income elasticities are statistically elastic, implying that, as their income increases, their expenditure on agri-food imports from Pakistan increases disproportionately. Hence, lower-middle-income countries are viable growth markets for Pakistani exports.

## 5. CONCLUSION

As the predominant sector of the country's economy, agriculture—including agri-food and cotton products—accounts for 80 percent of the country's exports. However, these exports are concentrated in very few markets, most of them, developed countries. The slow economic growth of developed countries, coupled with the recent financial crises, could negatively affect their demand for Pakistani exports. Using agri-food export data on 29 products exported to 36 developed and developing countries, this study has estimated a series of import demand functions and investigated the role of economic growth in the importing countries in their demand for Pakistani agri-food exports. The analysis shows that lower-middle-income countries are the best growth market for Pakistani agri-food exports since only economic growth in these economies can potentially enhance the demand for agri-food imports from Pakistan.

The overall policy implication of the analysis is that Pakistan should, accordingly, focus more heavily on middle-income economies and take advantage of their rising economic growth. Demand for Pakistani products in developed countries has declined and, given their economic growth and income elasticities, may decline further still. Further, Mustafa (2003) indicates that, compared to developing economies, developed economies have higher sanitary and phytosanitary (SPS) requirements, which Pakistan's weaker infrastructure is not necessarily equipped to deal with. Hence, the country must diversify its exports and take advantage of the higher economic growth in developing economies. However, further analysis is needed to identify those specific countries within the lower-middle-income bracket that drive these results. Such analysis could also determine which individual product sectors to focus on and investigate the rationale for bilateral and multilateral trade agreements to take advantage of the growth occurring in middle-income economies.

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