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The Impact of Emigrants, Trade Costs, and Trade Agreements on Exports of Pakistan

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ABSTRACT

This paper examines the impact of the stock of Pakistani emigrants, trade costs, and trade agreements on exports of Pakistan. While using panel data of 30 importing partners of Pakistan, the study utilizes pooled mean group estimator, for the period 1995 to 2021. As a precursor, this study estimates the trade costs separately for export-oriented agricultural goods and manufactured goods. The study results show that overall trade costs are declining over time and vary across trading partners. The impact of trade costs on exports is negative and statistically significant both in the short run and long run. Moreover, the impact of the stock of emigrants residing in trading partner countries is positive and significant for agricultural exports while insignificant for manufactured exports in the long run. Finally, the impact of trade agreements, between Pakistan and its trading partners, is statistically significant and positive for manufactured exports while insignificant for agricultural exports. The paper concludes with six important trade policy recommendations for Pakistan.

Key Words: Agricultural exports, Pakistan emigrants, exports, gravity model, manufactured exports, pooled mean group estimator, trade agreements, trade costs

INTRODUCTION

The determination of the impact of immigrants on trade flows, *the immigrant-trade nexus,* of host countries has remained a widely discussed topic in international trade literature, over the last two decades. In this regard, the pioneering work of Gould (1994) has proved to be a source of inspiration for trade researchers, and a wave of parallel studies is also part of the literature. The empirical results of such studies, overwhelmingly, support the idea of the positive impact of the stock of immigrants on exports of host countries.[1] On the other hand, fewer researchers[2] have investigated the *emigrant-trade nexus,* from home/native countries' perspective, though they have confirmed a positive relationship.

Theoretically, the familiarity of emigrants with the common attributes of native countrymen may help in reducing countries' specific trade costs and boosting their exports. In fact, the stock of a country's emigrants in its trading partner countries plays a significant role in enhancing exports via a reduction in explicit trade costs that include: contract costs, communication costs, and information costs (Karagoz, 2016). Emigrants are known to stimulate their home countries' trade, particularly, when they are natives of developing countries (Tadesse & White, 2011).

In the case of Pakistan,[3] particularly, the studies on the *emigrant-trade nexus* are limited,[4] mainly because of the non-availability of data on stock of Pakistani emigrants, for certain years.[5] Current study fills the research gaps and enriches the trade literature keeping in view the

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[1] See e.g., (Head &Ries, 1998), (Dunlevy & Hutchinson, 1999), (Rauch, 2001), (Wagner et al., 2002), (Girma& Yu, 2002), (Co et al., 2004), (Tai, 2009), (Hatzigeorgiou &Lodefalk, 2015, 2016, 2019).

[2] See e.g., (Tadesse & White, 2011), (Hiller, 2014), (Karagöz, 2016), (Wojtas&Białowąs, 2017).

[3]A developing country was selected as a test case.

[4] See e.g., (Akbari &Hyder, 2011), (Hyder et al., 2016).

[5] Data on stock of Pakistani emigrants are available with a gap of every 5 years; current study utilizes geometric mean formula, to recover the missing data values, for all selected countries. Details could be provided on demand.

importance of the *emigrant-trade nexus* for economic growth. It is pertinent to mention here that until December 2022, the total number of registered emigrants from Pakistan to different parts of the world has been reported as 12.46 million.[6] The majority of these emigrants frequently visit Pakistan, and on return to their foreign destinations, they take with them local goods for personal use and commercial activities. The prime objective of the study is to investigate the impact of Pakistani emigrants on agricultural and manufactured exports of Pakistan to 30 major trading partner countries,[7] over the period of 26 years i.e., from 1995 to 2021.[8]

Agricultural exports are covered under Standard International Trade Classification (SITC), Revision-2, codes; 00 (Food and live animals chiefly for food), 01 (Beverages and tobacco), 02 (Crude materials, inedible, except fuels), and 04 (Animal and vegetable oils, fats and waxes). Whereas, Manufactures' exports come under SITC, Revision-2, codes; 05 (Chemicals and related products, NES.), 06 (Manufactured goods classified chiefly by materials), 07 (Machinery and transport equipment), and 08 (Miscellaneous manufactured articles).

The study explicitly contributes to the literature by utilizing the trade costs data in the employed augmented Gravity Model of Trade (GMT), in addition to the detailed analyses of exports. With this regard, the trade costs data have been generated separately for exports of agricultural and manufactured items, applying Novy's (2013) formula. This formula comprehensively covers a broad collection of trade costs between two trading countries and discards the use of ad-hoc-based proxies. The ad-hoc based proxies include the geographical distance between trading partners, colonial links, same languages, landlockedness, contiguity, etc.

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[6]Retrieved from https://data.worldbank.org/indicator/SM.POP.NETM?locations=PK.

[7] The trading partner countries have been selected based on the maximum presence of Pakistani emigrants and the availability of required data. For the selected countries' list see, Appendix 1.

[8]Subject to availability of data for incorporated variables.

In international trade literature, the coherent reason for using such proxies is the non-availability of actual trade costs' data, especially at a disaggregated level (i.e., for sub-categories of exported items). Against this backdrop, the current study utilizes Novy's (2013) formula to generate the trade costs' data, for a comprehensive analysis.

Additionally, the current study investigates the impact of trade agreements that Pakistan has signed with selected trading partner countries. This supplementary investigation is expected to help policymakers understand the efficacy of such agreements. Another significant contribution of the current study is the use of Pooled Mean Group (PMG) estimation procedure. This procedure takes care of non-stationarity and heterogeneity issues in data. Thus, the robust analysis of exports, performed in the current study, is expected to assist policymakers in basing their export strategy while taking into consideration the emigrants from Pakistan, trade costs, and trade agreements.

The scheme of the remaining sections of the study is as follows: the second section reviews the relevant literature; the third Section provides the methodology; the fourth Section reports the empirical results; the fifth section discusses the empirical findings; and finally, the sixth section concludes the study and draws implications for export policies.

LITERATURE REVIEW

The debate on the *immigrant-trade nexus* spreads over the past three decades. Gould (1994) studies the impact of immigrants on the trade flows of the USA. He confirms the significant positive impact of a number of immigrants (settled in the USA) on the USA's trade flows towards immigrants' native/origin/home countries. Similarly, Head and Ries (1998) confirm the positive impact of a number of immigrants (residing in Canada) on exports of Canada to selected 136 origin countries of the immigrants. Thereon, a stream of studies, on the investigation of immigrants' impact on trade flows, became part of the international trade literature.

In line with theory, the findings of a number of related studies support the positive impact of immigrants on the trade flows of host countries. For instance, Dunlevy and Hutchinson (1999) find the positive impact of a number of immigrants (from 17 countries) on the imports of the USA. Wagner, *et al.* (2002) confirm the significant positive impact of immigrants, residing in five provinces of Canada, upon Canadian imports from immigrants' origin countries. Girma and Yu (2002) examine the impact of the stock of immigrants (from the commonwealth and non-commonwealth countries) on the exports of the United Kingdom. They find the strong *export-immigration nexus* for the immigrants of non-commonwealth countries, only. Rauch (2001) explains that several empirical studies confirm the positive role of social networks in enhancing international trade. Co and colleagues (2004) find a positive immigration-trade connection for USA (the origin of immigrants) state-level exports to 28 countries. Similarly, Tai (2009) finds that immigrants positively affect Switzerland's imports and exports. However, this effect is larger for Switzerland's imports than its exports. Hatzigeorgiou and Lodefalk (2015, 2016, and 2019) find the positive impact of immigrants on Swedish exports.

Correspondingly, on the *emigrants-trade nexus*, Karagöz (2016) confirms the positive and significant impact of the stock of Turkish emigrants, to 13-member countries of Organization for Economic Co-operation and Development (OECD), on bilateral trade volume during the study years, i.e., 2000-2012. Tadesse and White (2011) utilize a stock of emigrants' data for the year 2005, from 110 destinations and 131 home countries. They find a positive impact of emigrants on trade flows of their origin and destination countries. Moreover, they confirm that the stock of developing countries' emigrants stimulates trade flows of their home countries more as compared

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to the emigrants of developed countries. Hiller (2014) finds a positive impact of the stock of Danish emigrants residing within Europe, on exports of its manufactures, produced mainly by small firms. Wojtas and Białowąs (2017) report the increase in Polish exports due to an increase in its stock of emigrants in the United Kingdom, Netherlands, and Ireland, from 2004 to 2015.

An overview of the comparative international trade literature reveals that the number of studies on the investigation of the *immigrants-trade nexus* is greater than the studies on the *emigrants-trade nexus.* Particularly, in the case of Pakistan, the studies on the *emigrant-trade nexus* are limited. Akbari and Hyder (2011) find the positive impact of the stock of Pakistani emigrants on net exports of Pakistan in the case of English-speaking OECD countries. However, this impact turned out negative in the case of non-English speaking OECD countries, where the stock of Pakistani emigrants did not increase significantly over the period of study, i.e., from 1990 to 2003. Hyder and colleagues (2016) found the positive impact of the stock of Pakistani emigrants on its exports, in the case of selected Middle Eastern countries every single emigrant contributed $422 to Pakistani exports, over the period of study, i.e., from 1982 to 2013.Fatima (2012) finds a positive impact of emigration from Pakistan on its exports.

Upon reviewing the related studies and identifying the research gaps, the current study attempts to enrich the literature on the *emigrant-trade nexus,* considering Pakistan as a test case. It explores this nexus at a disaggregate level, i.e., for agricultural and manufactured exports. Moreover, this study distinctively augments the employed GMT with a particular trade costs' variable, generated through Novy's (2013) formula. In addition to these contributions, this study employs PMG, for empirical analysis. The PMG estimation takes care of non-stationarity and heterogeneity issues in panel data and offers robust results.

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METHODOLOGY

The current study employs GMT for empirical analysis. The GMT has its basis in the Newtonian law of gravity, which describes that the gravitational pull between any two particles in the universe is directly proportional to the product of their masses and inversely proportional to the square of the distance between them. Tinbergen (1962) took the lead from the Newtonian law of gravity and postulated that the trade flows between any two countries of the world are directly proportional to their economic sizes and inversely proportional to the geographic distance between them. The real-time contribution of Pöyhönen (1963), in this context, is considered pioneering, as well. At the outset, GMT was considered empirically reasonable but theoretically baseless. However, notable research by Anderson and Van Wincoop (2003) provided the micro-foundations of GMT to theoretically remove the objection of being baseless.

The GMT includes the distance between trading partners as a proxy of trade costs. Theoretically, a longer geographical distance between trading partner countries costs more to transport trade items. Trade researchers mostly use this proxy to incorporate the impact of trade costs in the augmented GMT. However, unlike this normal practice of using geographical distance as a trade costs' proxy, the current study utilizes Novy's (2013) formula to work out trade costs.[9] These costs have separately been traced for both cases, i.e., agricultural and manufactured exports. Additionally, the current study augments the employed GMT with certain other explanatory variables to examine their impact on selected exports.[10]

Trade Costs

Trade costs are considered as an extremely important factor in the determination of the volume of bilateral trade flows between trading partner countries. However, limited or no availability of

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[9] Computation details could be provided, on demand.
[10] The details regarding explanatory variables have been provided in section 3.2.

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actual total trade costs data is a major barrier in economic research. To overcome this issue, different proxies are included in GMT to capture the impact of trade costs on bilateral trade flows of trading countries. These proxies include: geographical distance, contiguity, exchange rate differences, colonial links, and same or different languages.[11] International trade literature is enriched with studies that capture the trade costs with such proxies. However, these commonly used proxies do not comprehensively address bilateral trade barriers.

In fact, the bilateral trade flows are also influenced by other multilateral trade impediments. For instance, if any country raises the trade barriers for all countries except for those partners that are already in some trade agreement with it, then, ceteris paribus, the magnitude of trade flows would be increased in favor of the trading partner countries. Thus, both bilateral and multilateral barriers, in relative terms, are important to be considered. Anderson and Wincoop (2003) consider these barriers, and Novy (2013) takes lead from their work to transform GMT to a micro founded trade costs' formula.

Novy's (2013) trade cost formula captures the impact of overtime changes in intra-national and international trade and thus is appropriate to be considered for panel data analysis. In particular, the formula could be used to calculate the average trade costs for distinct years. Moreover, being comprehensive, the formula rules out the use of geographical distance and other proxies in the augmented GMT. The final form of Novy's trade costs' formula is as follows:

$$\tau_{ij} = \left(\frac{x_{ii}x_{jj}}{x_{ij}x_{ji}}\right)^{\frac{1}{2(\sigma-1)}} - 1$$

[11] ur Rehman & Mahmood (2014) prefer use of CIF values, reported by importing partner, over the FOB values, reported by exporting country, to incorporate the effect of trade costs in the model.

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where, τ_{ij} is the trade costs' ratio that captures the intra-national and international trade flows. This has been weighted by elasticity of substitution σ . Thus, it could be considered as a geometric average of trade costs that occur on a bilateral basis between exporting country *i* and importing country *j*. Moreover, x_{ij} and x_{ji} represent the trade flows from country *i* to country *j* and from country *j* to country *i*, respectively. Whereas, x_{ii} and x_{jj} show the intra-national trade of country *i* and country *j* respectively. In essence, Novy's formula indicates that comparatively higher trade costs are an indication of more intra-national trade while lower are a sign of more international trade. Employing this formula, the current study renders trade costs' data, for agricultural and manufactured exports of Pakistan, against partner countries.

Estimated model

Current study employs following long run augmented GMT for analysis:

$$\mathbf{XF_{ijt} = \alpha_0 + \alpha_1 Y_{it} + \alpha_2 Y_{jt} + \alpha_3 Y_{jt}^{pc} + \alpha_4 EMG_{it} + \alpha_5 EXR_{ijt} + \alpha_6 TC_{ijt} + \alpha_7 TA_{ijt} + u_{ijt}} \quad \ldots (1)$$

where, XF_{ijt} represents exports of Pakistan to its partner country *j*. The subscript *j* represents the trading partner countries that are 30 in total, so *j* is from 1 to 30. While subscript *t* indicates time, in years i.e., from 1995 to 2021. The dependent variable XF_{ijt} includes: agricultural (AX_{ijt}) and manufactures (MX_{ijt}) exports. The agricultural products that come under the SITC, Rev-2, Codes: 0, 1, 2, and 4 have been included, for the empirical analysis. Similarly, manufactures that come under the SITC, Rev-2, Codes: 00, 01, 02, and 04 have been included, for the empirical analysis. Similarly, manufactures that come under the SITC, Rev-2, Codes: 05, 06, 07, and 08 have been included, for the empirical analysis.

The term Y_{it} represents the Gross Domestic Product (GDP) of the exporting country *i*, which is Pakistan in the current study. This variable has been used as a proxy for production capacity or export surplus of Pakistan. Y_{jt} and Y_{jt}^{pc} stands for GDP and GDP per capita of the trading partner country. Y_{jt} has been used as a proxy for market size of trading partner countries. Whereas Y_{jt}^{pc} has been used as a proxy to capture the purchasing power of residents of the trading partner countries.

Similarly, EMG_{ijt} represents the stock of Pakistani emigrants residing in trading partner country *j*. The EXR_{ijt} is the real exchange rate, Pak Rupee vs particular currency of the trading partner country. The TC_{ijt} represents trade costs that Pakistan faced while exporting to its partner country *j*. The TA_{ijt} stands for all trade agreements, between Pakistan and trading partner country *j*. This variable is used as a dummy. It takes value 1 from the year when any trade agreement with a particular trading partner country came into effect, and 0, otherwise. Finally, u_{ijt} is the error term, which captures the impact of all excluded (due to data availability issues) explanatory variables on exports of Pakistan. The signs of coefficients; α_1, α_2, α_3, α_4, α_5, and α_7 are expected to turn up as positive. Whereas the sign of α_6 is expected to turn up as negative. The focus of current study is to confirm the signs of α_4, α_6, and α_7.

The Pooled Mean Group Estimator

A traditional Dynamic Fixed Effect (DFE) estimator relies on pooling of cross-sections, a Mean Group (MG) estimator relies on averaging of cross-sections, and a PMG estimator relies on a combination of pooling and averaging of coefficients (Blackburne & Frank, 2007). The Hausman test results recommend the use of PMG[12] estimator for both under consideration cases.

Moreover, the PMG estimation takes care of non-stationarity and heterogeneity issues in panel data and offers robust results. It relies on a combination of pooling and averaging of

[12] Hausman test results are provided in Appendices 5-7 (for agricultural goods' case) and Appendices 7-10 (for manufactured goods' case).

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coefficients (Pesaran et al., 1999). It also determines the short-run and as well as the long-run relationship between the variables.[13]

Equation (1) represents the long-run relationship between exports and its potential determinants between Pakistan and its trading partners. For empirical estimation, this study relies upon the Pooled Mean Group (PMG) estimation procedure of Pesaran et al. (1999).

The estimation of PMG is based on two steps. First, the short-run dynamics can be determined by data for each country. Second, the long-run coefficients and the speed of adjustment to the long-run are estimated.

For this purpose, equation (1) has been reformulated as an autoregressive distributed lag (ARDL) model:

$$\mathbf{Ex_{it}} = \sum_{j=1}^{p} \lambda_{ij}\, \mathbf{Ex_{i,t-j}} + \sum_{j=0}^{q} \delta_{ij}\, \mathbf{X_{i,t-j}} + \mu_i + \varepsilon_{it} \qquad \dots (2)$$

where, $X_{i,t-j}$ is a vector of independent variables that includes; Y_{it}, Y_{jt}, Y_{jt}^{pc}, EMG_{ijt}, EXR_{ijt}, TC_{ijt}, and TA_{ijt}.

Similarly, μ_i stands for fixed effects and ε_{it} is assumed to be independent and identically distributed (*i.i.d.*), across time and group.

The error correction format of equation (2) can be specified as follows:

$$\Delta \mathbf{Ex_{it}} = \varphi_i(\mathbf{Ex_{i,t-1}} - \alpha_{0i} + \alpha_i' \mathbf{X_{it}}) + \sum_{j=1}^{p} \lambda_{ij}^{*}\, \Delta \mathbf{Ex_{i,t-j}} + \sum_{j=0}^{q} \delta_{ij}^{*}\, \Delta \mathbf{X_{i,t-j}} + \mu_i + \varepsilon_{it} \qquad \dots (3)$$

[13]The presence of long run cointegration has additionally been verified by applying Pedroni cointegration test, results are provided in Appendix 3 and 4, for under consideration cases.

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$$\varphi_i = -\left(1 - \sum_{j=1}^{p} [\![\lambda_{ij}\right);]\!] \alpha_i = -\left(\sum_{j=1}^{q} [\![\frac{\delta_{ij}}{\varphi_i}\right);]\!] \lambda_{ij}^{*} = -\sum_{m=j+1}^{p} \lambda_{im}, j = 1,2, \dots, p-1;$$

where,

$$\delta_{ij}^{*} = \sum_{m=j+1}^{p} \delta_{im}, \quad j = 1,2, \dots, q-1. \delta_{ij}^{*} = \sum_{m=j+1}^{p} \delta_{im}, \quad j = 1,2, \dots, q-1.$$

Distinctively, without the first term on the right-hand side, equation (3) is an error correction model, which uses the long-run relationship as a restriction to provide flexible short-run dynamics. In this model, the short-run impact is captured by the difference terms with optimal lag-length, chosen by minimizing the Akaike Information Criteria (AIC) and long-run impact is represented by the variables, in level. Moreover, α_i is the vector of coefficients, indicating the magnitude of long-run relationship and φ_i is the speed of adjustment.

Data Sources and Construction of Variables

The study utilizes 26 years' data, i.e., from 1995 to 2021. The data for agricultural and manufactures' exports have been accessed from the UN COMTRADE database. The data for gross domestic products and real exchange rates have been retrieved from International Financial Statistics[14]. The data on emigrants[15] have been accessed from the United Nations, Department of Economic and Social Affairs, Population Division[16].

The data series for dummy variable *TA* have been generated. It takes value 0 for trading partners with whom Pakistan has no trade agreement and 1 for those partners with whom Pakistan has any kind of trade agreement. It is pertinent to mention that Pakistan has no *TA* with European

[14]International Financial Statistics: https://data.world/imf/international-financial-statis

[15] Emigrants' data are available with 5 years' gap. The missing data values have extensively been filled, utilizing the geometric mean formula.

[16]United Nations, Department of Economic and Social Affairs, Population Division:https://www.un.org/development/desa/pd/data-landing-page

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Union countries. However, it avails generalized scheme of preferences (GSP) plus status, which facilitates Pakistani exports through duty free access on 66 percent of the European Union (EU) tariff lines. The data series contains 0 values for all those years when there was no trade agreement between Pakistan and the trading partner country. However, it takes value 1 from the year during which Pakistan signed any trade agreement or obtained GSP plus status. Finally, data for trade costs[17] have been generated using Novy's (2013) formula.[18]

RESULTS

Table 1 reports trade costs' equivalents for trading partner countries. The results indicate that on average trade costs decreased, over time, to most of the selected countries. The results also show that from 1995 to 2015 the trade costs of Pakistani agricultural exports have decreased significantly. However, from 2016 to 2021 trade costs increased again. Moreover, Indonesia and Malaysia, which are close trading partners of Pakistan, have turned up with the lowest trade costs' equivalents, i.e., 76.84 and 80.65, respectively. Whereas, in the case of Japan, Italy, and Qatar, Pakistan bore the highest trade costs; the equivalents for these trade partners are 210.33, 297.03, and 254.74 respectively. For other selected countries, trade costs' equivalents are between these extremes.

Table 1
Trade Costs' Equivalents for Agricultural Exports of Pakistan

Year	1995-2000	2001-2005	2006-2010	2011-2015	2016-2021
Indonesia	118.90	111.43	89.62	77.38	76.84
Malaysia	73.67	84.57	68.78	68.55	80.65

[17] Trade costs' equivalent values have been averaged, for every five years i.e., from 1995 to 2015 and finally for six years, i.e., from 2016 to 2021. All estimated values have been multiplied by 100, for comparison in percentage form.
[18] The estimation details could be provided on demand.

Canada	126.35	126.46	97.40	98.59	94.13
Thailand	116.93	118.17	100.34	95.20	96.10
Australia	116.43	109.23	101.89	87.17	96.99
Netherlands	123.01	121.13	106.77	98.52	99.23
USA	117.07	128.71	113.47	105.63	99.95
New Zealand	131.27	136.83	109.12	102.51	105.14
UAE	161.84	140.72	113.70	113.13	105.88
Iran	179.74	159.94	131.91	116.47	110.24
Belgium	151.26	138.67	118.74	113.92	112.52
UK	147.27	142.53	124.58	119.19	114.43
China	148.26	143.15	124.02	115.42	118.37
Germany	157.41	148.42	134.14	123.47	125.17
Singapore	121.80	143.70	135.31	125.59	127.73
France	153.60	143.65	136.30	125.53	131.24
Denmark	165.48	166.31	155.78	132.56	132.79
Sweden	177.14	173.70	141.09	131.58	134.19
Turkey	160.95	188.57	158.93	152.86	147.81
Oman	217.84	209.12	164.52	145.98	149.59
Hong Kong	161.61	217.84	192.60	170.61	150.60
Austria	193.90	198.87	160.97	151.82	152.47
Korea	152.03	168.14	146.93	137.44	156.93
Saudi Arabia	226.03	213.43	170.66	171.76	174.17
Norway	195.21	194.26	181.13	174.59	174.87
Kuwait	230.41	274.68	198.43	184.51	182.26
Switzerland	229.98	226.03	184.49	183.33	185.04
Japan	199.01	206.28	193.27	179.54	210.33
Qatar	409.61	323.60	332.06	281.95	254.74
Italy	376.38	361.57	316.72	296.48	297.03

Source: Authors’ calculations

The comparative analysis of costs, reported in Tables 1 and 2, shows that Pakistan bears more trade costs in the case of manufactures' exports as compared to agricultural exports. However, trade costs' trend is same in manufactures' exports as it is in the case of agricultural exports, i.e., declining from 1995 to 2015 and rising from 2016 to 2021.Table 2 reports trade costs' equivalents for manufactures' exports.

Table 2
Trade Costs' Equivalents for Manufactures' Exports of Pakistan

Year	1995-2000	2001-2005	2006-2010	2011-2015	2016-2021
China	193.97	167.83	138.07	118.00	125.17
UAE	162.48	148.55	121.94	126.19	129.40
Belgium	181.57	166.72	141.46	136.02	137.47
Singapore	125.59	146.09	159.36	142.14	141.80
Germany	168.20	171.69	156.56	155.58	154.06
Netherlands	183.37	182.99	162.03	159.40	156.16
Italy	187.62	183.49	160.08	168.99	163.55
UK	166.52	166.96	159.99	157.68	164.12
Korea	162.77	164.04	167.92	160.19	166.23
Hong Kong	146.86	150.12	153.45	151.52	167.43
USA	173.53	172.25	154.28	165.36	169.35
Thailand	206.54	190.06	179.81	170.40	169.60
Saudi Arabia	177.17	164.45	163.31	158.31	172.10
Malaysia	201.45	183.01	165.27	165.82	176.78
Turkey	222.02	209.68	179.40	180.78	188.24
France	187.92	192.74	185.38	190.41	191.67
Sweden	204.55	213.90	184.71	190.04	194.28
Japan	177.66	203.46	202.68	195.47	194.95
Kuwait	246.41	186.28	191.49	186.68	207.34

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Denmark	233.68	238.58	219.39	217.63	207.99
Indonesia	257.14	233.44	221.55	214.52	210.21
Iran	330.75	250.01	227.15	207.14	210.22
Qatar	250.11	247.73	200.58	223.04	211.13
Australia	234.77	230.77	219.97	221.44	217.41
Oman	270.49	257.96	193.79	191.80	224.26
Switzerland	216.79	221.63	228.71	232.92	230.24
Canada	237.77	225.29	220.02	232.61	230.31
Austria	256.33	249.93	230.16	248.90	254.69
New Zealand	280.77	267.64	260.94	258.38	277.52
Norway	283.35	293.64	274.13	306.03	312.88

Source: Authors' calculations

The statistics presented in Table 3 reveal important facts about variables of interest. For instance, high standard deviations for exports variables (1.43 for manufactures, and 1.62 for agricultural products) show significant variation, over time. The same fact could also be observed through significant differences among maximum and minimum values of the same variables.Moreover, the standard deviation of Pakistan's GDP is the lowest as compared to all other variables. Furthermore, the differences between maximum and minimum values regarding partner countries' GDP, GDP per capita, and real exchange rate indicate that selected countries are heterogeneous in attributes. Similarly, the difference between the maximum and minimum values of emigrants' stock shows the varying trade creation effect among different countries. The cross-correlations among variables show the absence of a multicollinearity problem in the analysis, as reported in Appendix 2. Table 3 provides the summary statistics of all data variables.

Table 3

Summary Statistics

Variable	Mean	Standard Deviation	Minimum	Maximum
$\mathbf{MX_{ijt}}$	18.57	1.43	14.92	22.17
$\mathbf{AX_{ijt}}$	16.78	1.62	11.21	20.25
$\mathbf{Y_{it}}$	25.76	0.28	25.32	26.26
$\mathbf{Y_{jt}}$	27.11	1.32	24.21	30.51
$\mathbf{Y_{jt}^{pc}}$	10.2	0.93	7.11	11.43
$\mathbf{EMG_{ijt}}$	9.89	1.85	4.49	14.13
$\mathbf{EXR_{ijt}}$	1.43	2.77	0.01	9.68
$\mathbf{TC_{ijt}}$	1.74	0.38	0.55	3.52
$\mathbf{TA_{ijt}}$	0.09	0.29	0.00	1.00

Source: Authors' calculations

Table 4 reports the variables that are non-stationary at level (5% level of significance) while stationary at first difference. As a pre-requisite, the panel-unit-root test suggested by Im, Pesaran, and Shin (2003) has been employed to test the non-stationarity issue in the data. The results provided in Table 4 show that variables are integrated in order 1.

Table 4

Im, Pesaran and Shin W-stat (Null Hypothesis: There is a unit root)

	Level		1st Diff.	
Variables	Statistic	Prob.	Statistic	Prob.
$\mathbf{MX_{ijt}}$	0.05	(0.52)	-15.00	(0.00)
$\mathbf{AX_{ijt}}$	0.26	(0.60)	-14.52	(0.00)
$\mathbf{Y_{it}}$	14.42	(1.00)	-6.22	(0.00)
$\mathbf{Y_{jt}}$	3.20	(1.00)	-10.58	(0.00)

Y_{jt}^{pc}	1.10	(0.86)	-10.12	(0.00)
EMG_{ijt}	3.11	(1.00)	-0.41	(0.04)
EXR_{ijt}	4.93	(1.00)	-8.31	(0.00)
TC_{ijt}	-1.73	(0.08)	-13.51	(0.00)
TA_{ijt}	3.67	(1.00)	-6.02	(0.00)

Source: Authors' calculations

Table 5 reports the short-run determinants of agricultural and manufactures exports. The results of the test show that the sign and magnitude of coefficients of the explanatory variables reflect the expected direction and magnitude of impact on the explained variable. The estimates show that Y_{it} is negatively associated with its exports. The negative association is significant at the disaggregate level, i.e., for agricultural and manufactured products.

Table 5
Short-run Pooled Mean Group Estimates

Independent Variables	Manufactures	Agricultural
ΔY_{it}	-1.64 (0.00)	-1.61 (0.00)
ΔY_{jt}	-1.01 (0.09)	0.91 (0.23)
ΔY_{jt}^{pc}	2.54 (0.05)	-0.15 (0.43)
ΔEMG_{ijt}	0.74 (0.49)	0.44 (0.42)
ΔEXR_{ijt}	0.13 (0.07)	0.03 (0.67)
ΔTC_{ijt}	-1.30 (0.00)	-0.47 (0.00)
ΔTA_{ijt}	0.01 (0.52)	0.02 (0.07)

Error Correction term	-0.34 (0.00)	-0.31 (0.00)

Source: Authors' calculations

The third variable Y_{jt}^{pc}, has been used as a proxy for purchasing power in the trading partner country. The sign of the coefficient for Y_{jt}^{pc} should be positive, theoretically. Table 6 shows that the sign of coefficient for Y_{jt}^{pc} is positive and significant, in the case of manufactures. The results suggest that a one percent increase in Y_{jt}^{pc} stimulates manufactures' exports by 2.54 percent in the short-run. Thus, in the short-run Pakistan may take advantage of exporting its manufactures to partner countries, as the purchasing power of people increases in those countries. Whereas, in the case of agriculture, the coefficient for Y_{jt}^{pc} is insignificant as most of the agricultural exports are primary goods and theoretically the income elasticity of primary goods is always less than one (income inelastic). Hence, increased purchasing power in trading partner countries has no impact on Pakistan's agricultural exports.

Moreover, like other studies such as; Atique and colleagues (2003) and Gul and Rehman (2014), this study also reports a positive relationship between exports and real exchange rate appreciation. However, only in the case of manufactured goods, the relationship is statistically significant. The weaker short-run relationship can be attributed to managed or over-valued exchange rate regimes in Pakistan, over the period of study.

The trade agreements facilitate exports; thus, a sign of the associated coefficient should be positive, theoretically. Table 6 shows that in the case of Pakistan trade, though the trade agreements are positively associated with all considered exports, but they only boost the exports of agricultural products, in the short run. On the other hand, in the case of manufactures the coefficient is insignificant because the manufacturing sector takes time to adjust to the new free trade environment.

The impact of trade costs and emigrants on exports, which is the main focus of the current study, is expected to be negative and positive respectively. The empirical results (reported in Table 6) show that trade cost is the only most important variable determining short-run exports from Pakistan to selected trading partners. The sign of the coefficient in each case is negative, which implies that the high trade cost reduces exports in the short run. The magnitude of the estimated coefficients shows that due to a one percent increase in the trade cost, manufactures' exports fall by 1.30 percent and agricultural exports fall by 0.47 percent. Finally, results show that the stock of emigrants has no short-run effect on selected exports. This is clearly an indication that emigrants take time to understand consumer preferences in the host market. Table 6 reports the long-run pooled mean group estimates.

Table 6
Long-run Pooled Mean Group Estimates

Independent Variable	Manufactures	Agricultural
$\mathbf{Y_{it}}$	0.89	0.98
	(0.00)	(0.00)
$\mathbf{Y_{jt}}$	-0.93	1.25
	(0.00)	(0.00)
$\mathbf{Y_{jt}^{pc}}$	1.49	-0.39
	(0.00)	(0.00)
$\mathbf{EMG_{ijt}}$	0.09	0.31
	(0.24)	(0.00)
$\mathbf{EXR_{ijt}}$	0.11	-0.23
	(0.00)	(0.00)
$\mathbf{TC_{ijt}}$	-0.79	-1.00
	(0.00)	(0.00)
$\mathbf{TA_{ijt}}$	0.18	0.30
	(0.00)	(0.14)

Source: Authors' calculations

The coefficients for Y_{it} for Manufactures and Agricultural exports of Pakistan have turned up positive and significant. This means that Pakistan's exports increase as the export capacity (supply/production) increases. For instance, one percent increase in export's capacity results in increasing Manufactures and Agricultural exports of Pakistan towards selected partner countries by 0.89 and 0.98 percent, respectively. Hence, Pakistan may take all necessary policy actions to expand its exports capacity.

The study includes Y_{jt} as a proxy for the market size and diversity of the trading partner country. The coefficients of Y_{jt} are significant for both cases. However, for Agricultural exports, the coefficient of Y_{jt} is positive while negative for manufactures exports. The negative sign of the coefficient in the case of agricultural exports explains that as the market size of partner countries increases,[19] the demand for agricultural products increases. One unit increase in the absorption capacity of selected partner countries results in 1.25 units increase in agricultural exports of Pakistan. Whereas the negative sign of the coefficient of Y_{jt} in the case of manufactures, is due to the increasing market size of trading partner countries, they prefer to import technologically more advanced manufactures from other trading partners. In view of these results, Pakistan could obtain the benefit of overtime increasing the market size of trading partner countries for exports of its manufactures, only if it becomes capable of exporting higher-end products, at competitive prices.

The explanatory variable Y_{jt}^{pc} captures the purchasing power of residents of trading partner countries. The results show that the coefficients for this variable are significant; however, positive for manufactures and negative for agricultural products. The reason for a positive impact of Y_{jt}^{pc}

[19] The increased market size of partner countries is due to their increase in population, over time.

on manufactures' exports is that consumers from trading partner countries spend more on manufactures as their income increases. However, they spend less on agricultural products as compared to the increase in their incomes. These findings are consistent with the prediction of *Engel's Law*.

The impact of EMG_{ijt} on exports of manufactures is positive but insignificant. This may be because of two reasons: first, most emigrants are unskilled, unfamiliar with modern marketing strategies, and thus unable to promote Pakistani manufactures in their host countries; second, due to low-quality products and lack of diversification, Pakistani exports cannot cater the needs of all market participants. Whereas, in the case of Agricultural exports, the impact of emigrants is significant and positive. This may be because of two main reasons: first, emigrants prefer agricultural products of their home country because of their developed tastes; second, emigrants easily promote the agricultural products of Pakistan.

The coefficient of EXR_{ijt} is significant and positive for manufactures' exports, which confirms the increased demand of foreigners for Pakistani products, with improvement in competitiveness on account of the real depreciation of the Pak Rupee. On the other hand, for agricultural exports, the impact of the exchange rate is statistically significant but negative, which represents that the real depreciation of the Pak Rupee decreases foreigners' demand for Pakistani agricultural products. The perversity of sign is justified because Pakistan imports high-priced inputs for its agricultural sector that adversely affect the export surplus and cause agricultural exports to fall. Thus, Pakistan may remove exchange rate misalignments, as and when they arise.

The impact of TC_{ijt} on both types of exports is negative and highly significant. These results are absolutely in line with the economic theory. Particularly, in the case of agricultural products, a unit increase in trade costs reduces the exports by about exactly one unit. The trade costs coefficient for manufactures is 0.79, which is smaller than the coefficient of agricultural exports. Thus, to enhance exports, Pakistan may improve its trade facilitation system. The improved trade facilitation will help in reducing the trade costs down to the minimum possible level.

Finally, the coefficient for TA_{ijt} is significant and positive in the case of manufactures exports. However, they are insignificant in the case of agricultural products, which may be because agricultural commodities are mostly not covered in free trade agreements. The empirical findings suggest that Pakistan may concentrate more on the export of its manufactures to get the potential benefit of trade agreements.

DISCUSSION

Pakistan bears the lowest trade costs among Asian countries like, Indonesia, Malaysia, Thailand, and Iran. A similar trade costs pattern could be observed for Australia and New Zealand. However, in the case of Middle Eastern countries, where many Pakistani emigrants are residing, the trade costs are relatively high. The results show that in the countries where Pakistan faces low trade costs for agricultural exports, the trade costs' pattern for manufactures' exports is completely reversed. In the case of agricultural exports, Australia, New Zealand, and Canada are the partners where Pakistan bears significantly low trade costs as compared to other trading partners. However, in the case of manufactures' exports to these countries, Pakistan bears huge trade costs. Moreover, with China as the leading partner, Pakistan faces the lowest trade costs in the case of manufacturing exports, unlike agricultural exports. In fact, Pakistan bears the least trade costs for the export of its manufactures with China and UAE. The trade costs' equivalents in the case of these two countries are 125.17 and 129.40, respectively. Whereas, it faces maximum trade cost for export of manufactures towards Norway, i.e., 312.88.

For the remaining countries, the trade costs for manufactures' exports from Pakistan are moderate and between these extreme values. Theoretically, the sign for Y_{it} should be positive as has been found in several studies such as Majeed and Ahmad (2006), Atif and colleagues (2017), and most recently by Hussain and colleagues (2020). However, by differentiating the domestic aggregate demand and aggregate supply factors, Hussain and colleagues (2020) find that domestic demand factors are negatively related to the exports of Pakistan. The Y_{it} has been used as a proxy for capacity-to-export, but if this variable is considered as domestic absorption capacity in the short-run then its expected sign would be negative. In other words, in the short run, if internal demand for domestically produced products increases more than the production capacity of the economy then exports will be reduced.

The second important variable is Y_{jt}, which reflects the external market size for domestically produced goods. Theoretically, the sign of the associated coefficient should be positive. The results show that the coefficients for Y_{jt} are insignificant in the case of agricultural exports while significant though negative in the case of manufactures. The apparent reason for the negative sign of the coefficient is consumers' preferences with regard to consumption of manufactures. In fact, Pakistan is not competitive in the world market for its manufactures. So, as the sizes of their economies increase, people from selected trading partner countries prefer high-end manufactures, imported from technologically advanced countries.

CONCLUSION AND POLICY RECOMMENDATIONS

The current study employs pooled mean group estimator to empirically investigate the *emigrant-trade nexus* for Pakistan. It utilizes the panel data of 30 importing partners of Pakistan, from 1995 to 2021. Besides its prime objective of analyzing the impact of emigrants on exports of Pakistan, the study incorporates several other important factors in the empirical model. Particularly, for robust results, the study generates trade cost data, using Novy's formula, and investigates the impact of this important determinant on exports of agricultural and manufactured goods of Pakistan. The main conclusion drawn from the empirical analysis is the following:

First, trade costs for both agricultural and manufacturing exports show a declining trend during the period 1995-2015, which is consistent with the adoption of trade liberalization policies by Pakistan and its trading partners. However, this trend was reversed in the succeeding period (2016-2021) as Pakistan once again started using restricted trade policies owing to an unprecedented rise in its current account deficit. Pakistan needs to continually reduce its trade costs if it must expand its exports.

Secondly, emigrants have become a key source of export promotion from Pakistan to the selected trading partner countries. The impact of the stock of emigrants is highly significant for agricultural exports because emigrants have a special taste for their home country's rice, vegetables, fruits, and other food items. Contrary to agricultural exports, emigrants appear to have a weak preference for manufacturing goods imported from their home country, mainly because of the low quality of products exported by Pakistan that are not suited to their more sophisticated tastes in foreign countries. This finding calls upon policymakers to improve the quality of export products not only for emigrants who prefer their home country's products but more so to cater the non-Pakistani customers.

Thirdly, the trade agreements significantly and positively affect manufactures' exports while they are insignificant in the case of agricultural exports. Thus, Pakistan may draw the benefit of exporting high-quality manufactures to members of trade agreements. Additionally, Pakistan may cover its high-end agricultural products in trade agreements to get the full benefit of its potential. In addition to the existing preferential agreements with trading partner countries, Pakistan should make efforts to conclude the long pending free trade agreements with the USA, the UK, and the European Union.

Fourthly, the production capacity of Pakistan has a significant and positive impact on exports. Thus, Pakistan may focus on further enhancing its production capacity in the agricultural and manufacturing sectors to generate a large exportable surplus. Fifthly, the market size of selected partner countries significantly impacts both categories of exports. However, this impact is positive in the case of agriculture while negative in the case of manufactures' exports. Hence, in view of these results, Pakistan needs to focus on manufactures to meet the demands of large economies, keeping in view their diversity of tastes and preferences.

Finally, the higher purchasing power of residents of trading partner countries drives them to spend relatively more on manufacturing and less on agricultural products. So, Pakistan needs to focus on producing quality products for their exports to advanced countries having fast-changing consumption patterns. Also, exports are adversely affected by the overvaluation of the exchange rate. This calls for the maintenance of real competitiveness to expand exports. Considering the above conclusion, implications for the policy may be drawn as the following:

i. Reduce trade costs by liberalizing trade, improving the trade facilitation system, and becoming part of efficient global value and supply chains.

ii. Improve both quality and price competitiveness by improving productivity and efficiency via injecting innovation and high-end skills across the board.

iii. To harness export opportunities, Pakistan needs to activate its trade diplomacy to conclude more preferential trading arrangements.

iv. Pakistan has missed many export opportunities due to a lack of exportable surplus. Therefore, it must expand production capacity by increasing investment in export-oriented industries producing quality products.

v. Customers including emigrants based in large and developed export markets demand high-end manufactured products. To tap such markets, Pakistan needs to produce products according to customers' needs and fast-changing tastes.

vi. The central bank needs to maintain the real exchange rate close to equilibrium by stabilizing REER. Moreover, exchange rate and trade policy coordination is direly needed in situations of large exchange rate misalignment.

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The authors declare no conflict of interest

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The present study was approved by the Department of International Institute of Islamic Economics, International Islamic University

Author Contributions Statement
MSR conceptualized and conducted the study. All authors drafted and approved the final version of the manuscript.

Data sharing and availability statement
Data is available from the corresponding author based on request.

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Appendices

Appendix 1: List of Selected Countries

Serial No.	Country	Serial No.	Country	Serial No.	Country
1	Australia	11	Iran	21	Qatar
2	Austria	12	Italy	22	Saudi Arabia
3	Belgium	13	Japan	23	Singapore
4	Canada	14	Korea	24	Sweden
5	China	15	Kuwait	25	Switzerland
6	Denmark	16	Malaysia	26	Thailand
7	France	17	Netherlands	27	Turkey
8	Germany	18	New Zealand	28	UAE
9	Hong Kong	19	Norway	29	UK
10	Indonesia	20	Oman	30	USA

Appendix 2: Cross-Correlation between Variables

Variables	MX_{ijt}	AX_{ijt}	Y_{it}	Y_{jt}	Y_{jt}^{pc}	EMG_{ijt}	EXR_{ijt}	TC_{ijt}	TA_{ijt}
MX_{ijt}	1								
AX_{ijt}	0.48	1							
Y_{it}	0.15	0.23	1						
Y_{jt}	0.69	0.22	0.16	1					
Y_{jt}^{pc}	0.16	-0.31	0.12	0.02	1				
EMG_{ijt}	0.36	0.42	0.22	0.13	0.29	1			
EXR_{ijt}	0.11	0.01	0.19	-0.11	0.32	0.35	1		
TC_{ijt}	-0.5	-0.72	-0.21	-0.11	0.21	-0.37	-0.01	1	
TA_{ijt}	0.04	0.01	0.39	0.06	-0.07	-0.02	-0.11	-0.01	1

Source: Authors' calculations

Appendix 3: Pedroni Test for Cointegration (Agricultural Goods' Case)

Ho: No cointegration	Number of panels	=	30
Ha: All panels are cointegrated	Number of periods	=	26

Cointegrating vector: Panel specific

Panel means: Included	Kernel	Bartlett
Time trend: Not included	Lags:	2.00 (Newey-West)
AR parameter: Panel specific	Augmented lags:	1

	Statistic	p-value
Modified Phillips-Perron t	4.9389	0.0000
Phillips-Perron t	-10.6763	0.0000
Augmented Dickey-Fuller t	-10.6343	0.0000

Source: Authors' calculations

Appendix 4: Pedroni Test for Cointegration (Manufactured Goods' Case)

Ho: No cointegration	Number of panels	=	30
Ha: All panels are cointegrated	Number of periods	=	26

Cointegrating vector: Panel specific			
Panel means:	Included	Kernel:	Bartlett
Time trend:	Not included	Lags:	0.00 (Newey-West)
AR parameter:	Panel specific	Augmented lags:	1

	Statistic	p-value
Modified Phillips-Perron t	5.3726	0.0000
Phillips-Perron t	-6.0197	0.0000
Augmented Dickey-Fuller t	-5.9601	0.0000

Source: Authors' calculations

Appendix 5: Hausman Test Results (MG vs PMG), Agricultural Goods' Case.

. hausman mg pmg, sigmamore

	---- Coefficients ----			
	(b)	(B)	(b-B)	sqrt(diag(V_b-V_B))
	mg	pmg	Difference	S.E.
LnGDPi	2.29977	.4376556	1.862115	4.541412
LnGDPj	-17.70706	-.1932488	-17.51381	40.0223
LnGDPCj	15.6114	.1815609	15.42984	40.10873
LnEMG	1.468935	.0997553	1.36918	6.031604
LnRER	.6935063	.4220922	.2714141	1.565989
TB	-.9702199	-.7158582	-.2543617	1.789058
FTA	-.0850511	-.2149084	.1298573	.2731899

b = consistent under Ho and Ha; obtained from xtpmg
B = inconsistent under Ha, efficient under Ho; obtained from xtpmg

Test: Ho: difference in coefficients not systematic

chi2(7) = (b-B)'[(V_b-V_B)^(-1)](b-B)
= 0.52
Prob>chi2 = 0.9994

Source: Authors' calculations

Appendix 6: Hausman Test Results (MG vs DFE), Agricultural Goods' Case.

. hausman mg DFE, sigmamore

	---- Coefficients ----			
	(b) mg	(B) DFE	(b-B) Difference	sqrt(diag(V_b-V_B)) S.E.
LnGDPi	2.29977	-.1662196	2.46599	29.92433
LnGDPj	-17.70706	-.1144241	-17.59263	263.465
LnGDPCj	15.6114	1.266121	14.34528	264.0342
LnEMG	1.468935	.0234167	1.445518	39.70644
LnRER	.6935063	.1787336	.5147727	10.31417
TB	-.9702199	-2.214925	1.244706	11.8002
FTA	-.0850511	-.3082489	.2231978	1.981311

b = consistent under Ho and Ha; obtained from xtpmg
B = inconsistent under Ha, efficient under Ho; obtained from xtpmg

Test: Ho: difference in coefficients not systematic

chi2(7) = (b-B)'[(V_b-V_B)^(-1)](b-B)
= 0.04
Prob>chi2 = 1.0000

Source: Authors' calculations

Appendix 7: Hausman Test Results (DFE vs PMG), Agricultural Goods' Case.

. hausman DFE pmg, sigmamore

	---- Coefficients ----			
	(b) DFE	(B) pmg	(b-B) Difference	sqrt(diag(V_b-V_B)) S.E.
LnGDPi	-.1662196	.4376556	-.6038751	-
LnGDPj	-.1144241	-.1932488	.0788247	-
LnGDPCj	1.266121	.1815609	1.08456	-
LnEMG	.0234167	.0997553	-.0763385	-
LnRER	.1787336	.4220922	-.2433586	-
TB	-2.214925	-.7158582	-1.499067	-
FTA	-.3082489	-.2149084	-.0933405	-

b = consistent under Ho and Ha; obtained from xtpmg
B = inconsistent under Ha, efficient under Ho; obtained from xtpmg

Test: Ho: difference in coefficients not systematic

chi2(7) = (b-B)'[(V_b-V_B)^(-1)](b-B)
= 199.84
Prob>chi2 = 0.0000
(V_b-V_B is not positive definite)

Source: Authors' calculations

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Appendix 8: Hausman Test Results (MG vs PMG), Manufactured Goods' Case.

. hausman mg pmg, sigmamore

	---- Coefficients ----			
	(b) mg	(B) pmg	(b-B) Difference	sqrt(diag(V_b-V_B)) S.E.
LnGDPi	-.1083643	1.054339	-1.162703	1.612677
LnGDPj	4.657257	-.24389	4.901147	8.767666
LnGDPCj	-1.958421	-.4142986	-1.544122	8.733969
LnEMG	-1.69809	-.1485215	-1.549568	1.818872
LnRER	-.2479248	-.1517657	-.0961591	.5819928
TB	-.8678234	-.7000448	-.1677785	.6822564
FTA|	.0123053	-.0176772	.0299825	.0764025

b = consistent under Ho and Ha; obtained from xtpmg
B = inconsistent under Ha, efficient under Ho; obtained from xtpmg

Test: Ho: difference in coefficients not systematic

chi2(7) = (b-B)'[(V_b-V_B)^(-1)](b-B)
= 7.11
Prob>chi2 = 0.4177

Source: Authors' calculations

Appendix 9: Hausman Test Results (MG vs DFE), Manufactured Goods' Case.

. hausman mg DFE, sigmamore

	---- Coefficients ----			
	(b) mg	(B) DFE	(b-B) Difference	sqrt(diag(V_b-V_B)) S.E.
LnGDPi	-.1083643	.3913493	-.4997136	31.32684
LnGDPj	4.657257	-.2751196	4.932377	169.9368
LnGDPCj	-1.958421	.6864608	-2.644882	169.2785
LnEMG	-1.69809	-.0021852	-1.695905	35.27246
LnRER	-.2479248	-.0975586	-.1503662	11.29075
TB	-.8678234	-1.210379	.3425556	13.28331
FTA	.0123053	.13125	-.1189447	1.600055

b = consistent under Ho and Ha; obtained from xtpmg
B = inconsistent under Ha, efficient under Ho; obtained from xtpmg

Test: Ho: difference in coefficients not systematic

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chi2(7) = (b-B)'[(V_b-V_B)^(-1)](b-B)
= 0.01
Prob>chi2 = 1.0000

Source: Authors' calculations

Appendix 10: Hausman Test Results (PMG vs DFE), Manufactured Goods' Case.

. hausmanpmg DFE, sigmamore

	---- Coefficients ----			
	(b)	(B)	(b-B)	sqrt(diag(V_b-V_B))
	pmg	DFE	Difference	S.E.
LnGDPi	1.054339	.3913493	.6629895	2.207009
LnGDPj	-.24389	-.2751196	.0312296	3.904582
LnGDPCj	-.4142986	.6864608	-1.100759	3.653738
LnEMG	-.1485215	-.0021852	-.1463363	1.404625
LnRER	-.1517657	-.0975586	-.0542071	.5502776
TB	-.7000448	-1.210379	.5103341	1.293769
FTA	-.0176772	.13125	-.1489272	.6069736

b = consistent under Ho and Ha; obtained from xtpmg
B = inconsistent under Ha, efficient under Ho; obtained from xtpmg

Test: Ho: difference in coefficients not systematic

chi2(7) = (b-B)'[(V_b-V_B)^(-1)](b-B)
= 0.33
Prob>chi2 = 0.9999

Source: Authors' calculations