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Effects of Trade, Environment Quality and Human Capital on Industrial Sector Output in Developing Countries: A Panel Data Analysis

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ABSTRACT

The study is conducted to explore the effectiveness of various variables i.e. Trade, Environmental Quality and Human Capital on Industrial Sector Output by taking data of 63 developing economies, Panel Unit root and Panel ARDL approaches are applied for empirical results. The supporting variable are selected from theoretical support like Labor, Capital, Broad Money, GDP deflator and human capital. The study explores that Money Supply, Human Capital, Government Expenditure and Capital Stock are increasing industrial sector output, but it is reduced by Carbon Dioxide Emission, Trade Openness, Labor Force and Price Level.

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1. Introduction

Trade liberalization is one of the main goals of capitalism, which was implemented by international economic agencies like IMF and World Bank under structural adjustment programs in different countries of the world. Pakistan was also targeted for SAPs (Structural Adjustment Programs). This was implemented, simultaneously in multiple countries of the globe, which were all developing countries depending upon IMF funds. 'Chicago boys' were the students of Milton Friedman from Chicago school of Economics, who designed a rapid intensive pure capitalism program and started this implementation form Chile, back in 1974.

Lall (1995) pointed out that the impact calculation of SAPS on industrialization was ignored until 1990's. This however, was inevitable as every policy takes almost a decade or so to start giving results. Manufacturing sector was not that easy to adjust according to SAPs. This was because manufacturing sector was very much dependent upon subsidies, which if removed suddenly, would result in initial decline of the production processes. There are conflicting reviews in evaluation studies about the impact of trade liberalizing structural adjustment programs on manufacturing sector. Therefore, if we try to hypothesize the impact of trade liberalization on

manufacturing sector, the answer is not going to be very simple. Trade liberalization may have resulted in de-industrialization in Pakistan.

Different countries had different results and impacts of trade liberalization on the process of industrialization due to many confounding factors. Bangladesh is one example who has enjoyed accelerated industrialization 1980s implementation of SAPs. She did it by eradicating quantitative limitations and lessening in supreme and regular tariff duties. After first half of 1990s, speed of trade liberalization had slowed down to cover budgetary revenues and to prevent from the probable adversarial effects import challenging commerce due to liberalization of trade. This time-period was highly criticized by representatives from research, industry and public policy makers alike. Main criticism from them was rapid flooding of domestic markets with foreign products bringing tense competition for local infant industry. As trade liberalization policy was to imports friendly, therefore it adversely affected import competing industries and forcing closure to others (A. H. Khan & Hossain, 1994; F. C. Khan, 1994). Quantification of this trade liberalization was considered necessary for knowing the impact on manufacturing sector (Rahman, 1997).

Import substitution policy, which leads to export enhancement eventually, expected to underwrite more to methodological effectiveness in the economy. Another confounding factor due to which results of this impact varied in various countries was difference in infrastructure. Ways in which trade liberalization improves productivity is via through shutting down non-optimizing businesses and replacing them with more efficient manufacturing firms; nurturing scale proficiency, eradicating wastage in production. On the other hand, it increases efficiency in production process by bridging international provision gaps and access to inputs. Such improvements also lead to technological addition to production process, which in turn increases productivity (Ozler & Yilmaz, 2001, 2009). However, if due to liberalization of trade, protections and subsidies reduce and due to that, domestic market firms wither out then it may become the very reason for reduction in investments related to technology. Moreover, if institutional structure is weak then rapid liberal reforms can create instabilities Beim and Calomiris (2001), believed that stable institutions are necessity at this stage where rapid technological changes take place in order to avoid destabilization. Therefore, if a country wants to attain positive impact of trade liberalization on industrial efficiency, analysis should be via on ground realities and conditions.

Levinsohn and Petrin (2003) raised a doubt on the previous studies not to rationalizing the increase in industrial productivity. They also commented that the response to an increase in imports because of trade reforms was higher by small firms as compared to large firms. Ozler and Yilmaz (2001) reported a case study of Turkey where the productivity gains were largest during the era of continuous decease in protection rates. Productivity gain was mainly due to the imports competing sectors, which was due to trade reforms.

There are two generations that explain role of trade by growth theories. This first generation of endogenous growth models defines the influences of trade in the progression of growth through the positive externalities that build-up by both human and physical capital. The second generation of endogenous growth models explains the endogenous technological change in part of trade in the development of growth by way of the enhancement and allocation of research and development (R&D) activities.

Policies of 80s like import substitution, export enhancement etc. increased the importance of industrial sector as the driving force of economic development. It helps a country reap benefits from economies of scale, increasing foreign exchange reserves and increasing access to global markets (Chete & Adenikinju, 2002).

1.2 Environmental Quality and Industry

The environmental quality also pushes the industrial sector directed to the environmental friendly side. The world is experiencing the industrial revolution that meets the requirements of growing population, increase the living standards of the people plus a depletion of natural resources. The use of chemicals and fossil fuels of the factories are increasing in the air and water making them polluted. The impact of the industry on environment is very harmful, therefore; it is need of the date to concentrate on the importance of environmental quality. The pollutions of industry are not only dangerous for public health but also hurt the environment. These consequences bring climate changes, the green douse effects, emission of carbon dioxide and other chemicals and ozone hole. The pollution is not only caused by the above-mentioned issue but also through the excessive quantity of vehicles and trucks on the roads.

The specific tasks also documented for the specific issues concerning the environmental protection industry, current state of knowledge (industry) and gap between the knowledge to know and what is known currently. The phrase "the environmental protection industry" refers to the industries that produce and sell ecological friendly goods and services. As current state of industry is responsible in environmental degradation therefore the approach of environmental protection industry constituting various serious difficulties in it to date like assessing and measuring the industry. However, this approach can be viewed as something that is discrete from the regulated industries. It suggested the industrial benefits grow largely to supply the environmental protection industry with some extra costs to regulate such industries.

To protect the environment from degradation is not a personal issue that will be solve individually. It is like the diffusion and requires a collective attention that largely comes from the governmental regulation and intervention. These policies not only acquire the demand side attention but mainly from the supply side. The environmental protection industry is the need of the day. For example, environmental protection industry is internally a petrochemical sector and externally it is consulting engineering sector. Both sectors provide environmental protection goods and services to companies that fall under the regulations.

Another stricter environmental protection policy was adopted by China in 1998, which was considered as largest scale environmental policy. The regulation was imposed rigorous requirements to decrease the pollution and carbon dioxide emission in more than 200 zones exceeding nationally directed pollution standards. These zones were included lower-sulfur coal and adoption of clean technologies.

The significant difference of magnitude between the effects of regulation was differing in China relatively to US. Firstly, the drive within the industry resource allocation and firm business was leading to productivity growth because of environmental reforms. The main reason of the increase in the productivity growth was the reallocation of resources indicating that in developing countries the resources are mostly misallocate. Hence, it decreases the substantial productivity dispersion (Banerjee & Moll, 2010; Restuccia & Rogerson, 2013).

Under this circumstance, the regulation is likely to promote the markets dynamics and firms become more productive. Secondly, environmental policies also play a role in enhancing and highlighting the productivity if regulations motivate the polluting firms to do innovation. These innovations are expecting to work more in developing countries as compare to developed countries because developing countries has a base of low technologies. Here, innovations may cause low production performances and high emissions. Both channels partially move in the opposite direction and result as offset either effect or net positive effect of environmental regulation on industrial performance.

In short, the environmental protection industry and policies contribute in the productivity of industrial sector positively. The famous proverb works here strongly, "where there is a will, there is a way". If government regulates the reforms of environmental quality, then there will be new ways of production that will not only increase the productivity but also save the environment from further degradation. Industry has capacity to innovate new ways of production, new designs of products, and better solution for the waste of production process. Therefore, it is a heavy and most wanted duty of regulating authorities to design such framework that will be objected on the environmental protection industries. The study is conducted to explore the effect of Trade, Environmental Quality, Human Capital and of some supporting variables on Industrial Sector Output by taking data of 63 developing economies. The research questions of study are:

- How the environmental quality act as a determinant of the industrial sector growth in set of developing countries?
- How trade liberalization policies change the share of the industrial sector in developing countries?

2. Literature Review

The study of Environment, Trade and Industrial sector have been conducted earlier various time in different dimension and in different economies, this section presents overview of those studies. Yin, Zhang, and Huang (2022) emphasized on the emergence of strategic marine industry as a new economic growth tool. The regression model is used for the validation of relationship between market cultivation and marine industry by considering the data from 2006 to 2018. The results indicated that in China cultivation of market hampered the marine industry and therefore the funding support is needed from government.

Fu et al. (2021) had drawn attention towards the pollution association with environmental pressure when there was a transfer of industry from central region of china to western region. By collection the data of 30 states of china, it was studied that how pollution associated industrial shift showed a common trend by environmental regulation from the time of 2004-2016. In addition, it was also found that every region had its different regulations regarding environment. The study suggested to create an economic coordination for planning and implementation of effective regulation from east to west regions of China.

During the study of energy practice in the industry of cement in Bangladesh, Hossain et al in 2020 investigated that insufficient attention and staff awareness from the respective authorities like govt. there were some hurdles appeared in energy management and its efficient practices. This attitude might lead to high future prices and high demand due to lack of information and human capital deficit in the cement industry.

Li (2019) considered three approaches to explain the role of research and development in technological progress that was responsible for industrial growth and value addition. Three approaches of technological progress were technical co-operation, technical introduction and in-house research and development. The study also captured the role and impact of environmental regulation on the three approaches that was based on the data taken from industrial sector of China from 2005-2015. The findings were much expected as there was a negative impact of environmental regulation like a decrease in carbon emission on technical co-operation and technical introduction and no impact on research activities. The study also concluded that there was no significant effect of environmental regulation on the approaches in low polluting sectors of China.

Wang, Zhan, Bai, Chu, and Zhang (2019) pointed out the fact that green economic growth had been vital development plan adopted by OECD economies by formulation and implementing the safe environment policies and regulation. The study discussed the effect of environmental regulation on green productivity in selected region. A set of panel data had been analyzed to check the rigidity of anti-degradation polices on growth of green production. Poter hypothesis was employed and it validated a positive impact of environmental policy on growth of environmental friendly productivity within a limited level of rigidity. The study suggested that innovation activities were useful for the technical dynamics to keep growing and the innovations could substitute the passivity costs paid due to environmental policy to promote green earth.

Lin, Moubarak, and Ouyang (2014) highlighted the dilemma that reduction in environmental degradation by emission of carbon dioxide showed a negative effect on industrial growth in China. The study focused on the relation between carbon emission industrial growths of China's manufacturing sector. ARDL methodology validated the long run equilibrium between variables underlying during 1980-2012 by bound test. The empirics showed that policy measures that were adopted to decrease carbon emission might not inversely affect growth of manufacturing sector. These results proposed that any policy in order to reduce energy consumption and carbon emission for industries of China had potentially implemented without harming industrial growth.

When Adofu and Okwanya (2017) studied in Nigeria the relationship between trade liberalization and manufacturing productivity using data of 35 years starting from 1981, their VAR model depicted a positive and direct relationship between the two variables and also between real GDP and productivity of manufacturing sector. However, manufacturing output depicted a negative relationship in the long run with factor productivity of trade. They recommended increasing international trade as trade openness impacted more strongly the productivity.

Ajmair and Hussain (2017) explored the determinants of manufacturing sector growth in Pakistan. Neo classical method was utilized, and Autoregressive distributed lag model had selected for estimation the empirics. Annual data had used for estimation from 1976 to 2014. Empirical results showed trade was positively and significantly related with industry, value added had a negative and significant impact on industry. The empirical estimation indicated the presence of long run relation and structurally model was stable. The study proposed the policy that government must focus on the trade with other countries of world and on the quantity and quality of exports so that overseas employers encouraged and facilitated so that growth of the industries can be boosted up.

Beverelli, Fiorini, and Hoekman (2017) studied the effects of services trade constraints on manufacturing productivity for a broader set of cross-section data of 57 countries available at different stages of economic development. Three aspects of this research were the empirical valuation of the effects of services trade policy on the downstream the manufacturing industries to a heterogeneous set of countries, policy suggestion of an original instruments for the services trade boundaries to account for the endogeneity problems that were common to specifications at the country-sector level and lastly provision of a services policy-specific tests of the conditionality hypothesis. The measure of measure of performance or productivity, labor productivity had used. The data has been taken from the World Bank's Services of Trade Restrictiveness Database named as Services Trade Restrictiveness Index (STRI). The results reflected low rates of services trade restrictiveness were associated with higher downstream manufacturing sector productivity with the estimated effect that was increasing with country level institutional capacities. The positive productivity affected of lower trade restrictiveness in upstream services sectors. The result was not statistically significant for the countries with weak institutional environment.

Haq, Perveen, and Amin (2017) tested the hypothesis that trade liberalization affected economic growth through its impact on manufacturing value addition. The hypothesis tested empirically on a time series approach ranged from 1972 to 2012 by employed ARDL technique of estimation. The central argument of the study was that trade liberalization increase the market size of trading partners, encouraged innovations, and motivated new creation that enhance specialization. This study also focused on the idea that trade liberalization did not always push the manufacturing and economic growth performance upward. Empirical findings used unit root test to check stationarity of the variables employed and results showed variables were stationary at different levels therefore autoregressive distributive lag (ARDL) used. Bound test approach results estimated verified that co-integration existed among variables. The findings of the study safely concluded that manufacturing value addition was the main channel of trade openness influenced economic growth of Pakistan because manufacturing value addition was directly related with economic growth. Other finding of the study was core factors such as physical capital and human capital also affected the process of growth in Pakistan. The present study is based on finding the effect of Trade, Environmental Quality and Human Capital on Industrial Sector Output of 63 Developing Countries from 1990 to 2018

3. Data, Methods and Model Specification

The selection of developing countries is done in the present study to explore few variables i.e. Trade, Environmental Quality & Human Capital as major determinant of Industrial Sector Output. Panel data has been collected for 63 developing countries for the years from 1990 to 2018 and this data has been gathered by World Development Indicators assembled by World Bank Organization and Penn World Table 1 developed by Groningen Growth and Development Centre. Im, Pesaran and Shin (IPS) Panel Unit Root test has been used for checking stationary level of variables and then Panel ARDL test is used to obtain the empirical findings.

The functional form of the Model is presented as follows based on the research questions and objective of the study which considers few core and control variables.

$$Industrial\ Sector = [\ Trade, Environment, Human\ Capital, Control\ variables] \quad (1)$$

This Industrial Sector model may be written as follows in equation form with complete detail of variables;

$$INVA = \beta_{0i} + \beta_{1i} LBFR_{it} + \beta_{2i}\ CPST_{it} + \beta_{3i} TRDOP_{it} + \beta_{4i} Co2_{it} + \beta_{5i}\ GDPD_{it} + \beta_{6i}\ HMC_{it} + \beta_{7i}\ BMN_{it} + \beta_{8i}\ GVEX_{it} + e_{it} \quad (2)$$

Where, INVA is Industrial Value Addition, LBFR is Total Labor Force, CPST is Stock of Capital, TRDOP is Trade Openness, CO2 is Carbon Dioxide Emission, GDPD is GDP Deflator, HMC is Human Capital Index, BMN is Broad Money and GVEX is Government Final Consumption Expenditure. The study faces a limitation that the labor force engaged in industry is not available. Therefore, total labor force is taken as a factor of production.

3.1 Panel Unit Root Results in Developing Countries

The results of Im, Pesaran and Shin W (IPS) test are presented in table 1 which shows Capital Stock (CPST), Broad Money (BMN), Trade Openness (TRDOP), Government final Consumption Expenditure (GVEX), Carbon Dioxide Emission (Co2), Human Capital (HMC) and GDP Deflator (GDPD) are stationary at Level while Total Labor Force (LBFR) and Industrial Value Addition (INVD) are stationary at 1st difference. On this base, the study utilizes Panel ARDL technique for econometric results.

Table 1
Im, Peasaran & Shin W Test –Developing Countries

VARIABLES	Intercept		Trend + Intercept	
	Test Stat	P – Value	Test Statistics	Prob. Value
		LEVEL		
INVD	6.163	0.999	-0.926	0.107
LBFR	2.264	0.980	-1.245	0.100
CPST	4.493	0.999	-4.963	0.000
TRDOP	-4.459	0.000	-6.384	0.000
CO2	2.606	0.999	-8.255	0.000
GVEX	8.273	0.999	-7.400	0.000
BMN	6.058	0.999	-2.312	0.010
GDPD	-19.636	0.000	-11.245	0.000
HMC	0.798	0.788	-3.412	0.000
		1st DIFFERENCE		
INVD	-27.26	0.000	-23.555	0.000
LBFR	-13.393	0.000	-12.546	0.000

3.2 Trade, Environment Quality and Industrial Value Addition in Developing Countries

In table 2, it has been noticed that labor force is negatively (-0.3599) associated with industrial sector output at significance level of 1%. It is opposite to economic theory, but it may be justified as the size of labor force is much higher in all developing countries and they are labor abundant countries and labor is usually unskilled or semi-skilled so their contribution in industrial value addition is negative due to having negative returns at higher levels of labor force. Bakari and Mabrouki (2017) also supported this relationship with economic growth.

As Capital Stock is included in the study as a representative of the effects of Capital, it shows that ultimate advanced capital stock bring improvement in industrial sector in the case of developing countries this is consistent with Mouelhi (2007) for industrial sector.

If environmental quality is enriched and there is a clear environment, so it reflects a decrease in the carbon dioxide emission and proof of better quality of life and productivity. Here, Carbon Dioxide Emission is taken as proxy of environmental quality, but it has another interpretation apart from environmental quality. Intensive Industrialization may be harmful for Industrial Value Addition in a way that polluted environment will make human beings and human capital less capable in the industrial sector due to their poor health which is outcome of pollution generated by industrial expansion developing countries. Carbon Dioxide Emission is statistically significant at 1 percent level with 0.139 coefficient value in the long run decrease in industrial value addition in response of Carbon Dioxide Emission. Li (2019) and Lin et al. (2014) evaluated the same results for industrial sector of China.

Industrial sector will grow in the long run if developing-countries focus on the improvement so that the export sector will be able to export fully finished commodities and increase trade with rest of world. The value of estimated coefficient trade openness is statistically insignificant with industrial value addition in the long run. Industrial value addition has negatively predicted by Trade Openness and Beverelli et al. (2017) have the same result for industrial sector. Industrial value added has also positively increased due to increase in Money supply in developing countries. But GDP Deflator has been turned out to be reducing factor for Industrial value addition in the long run for developing economies as it generates inflation and this result is consistent with Faridi (2012) and Uremadu, Onyele, and Ariwa (2016). GDP Deflator may increase industrial value addition as in situation of Overall Developing Countries. The reason may be that it will provide incentive to industrialists in a way that higher price level will also increase

profitability and to get higher profit they would rush towards higher production levels in industrial sector which will ultimately lead to higher industrial output as it is already found by Gilbert and other researchers in 2013.

Fiscal Policy is another policy of government to achieve higher rates of growth in the longer period of time in developing-economies. Due to new and existing developmental projects and plans, industrial output may increase. The results given in the study suppose this phenomenon with positive sign attached with the variable Government Final Consumption Expenditure. This result is similar to the study conducted by Mehrara and Baghbanpour (2016) for 34 developing countries.

It is ultimate that Education and Health will have significant effect on Industrial sector output in developing countries and the study finds the positive sign attached with Human Capital variable having more elastic effect on Industrial Sector Output with significant probability value. Short run cointegrating term also supports convergence towards long run equilibrium with statistically significant value.

Table 2
Industrial Value Addition in Developing Countries

Variable	Coefficient	Standard Error	t-Statistic	Probability
Long-Run Equation				
LBFR	-0.359975	0.069543	-5.176313	0.0000
CPST	0.136450	0.026981	5.057242	0.0000
Co2	0.139199	0.036036	3.862790	0.0001
TRDOP	-0.000051	0.000235	-0.233654	0.8153
BMN	0.281232	0.024402	11.52501	0.0000
GDPD	0.297125	0.023795	12.48689	0.0000
GVEX	0.277402	0.030849	8.992324	0.0000
HMC	0.371777	0.122199	3.042399	0.0024
Short-Run Equation				
COINTEQ01	-0.305752	0.040095	-7.625662	0.0000
D(LBFR)	-2.171192	1.383846	-1.568954	0.1171
D(LBFR(-1))	1.268385	1.606369	0.789598	0.4300
D(CPST)	0.351645	0.186105	1.889496	0.0592
D(CPST(-1))	-0.313115	0.186631	-1.677727	0.0939
D(CO2)	0.082737	0.059030	1.401598	0.1615
D(CO2(-1))	-0.123398	0.049343	-2.500804	0.0126
D(TRDOP)	0.003374	0.001024	3.294316	0.0010
D(TRDOP(-1))	0.000373	0.001291	0.288620	0.7730
D(BMN)	0.292712	0.046148	6.342886	0.0000
D(BMN(-1))	0.068366	0.039923	1.712432	0.0873
D(GDPD)	0.595633	0.100221	5.943171	0.0000
D(GDPD(-1))	0.080753	0.065641	1.230223	0.2190
D(GVEX)	0.204312	0.054417	3.754585	0.0002
D(GVEX(-1))	0.002170	0.033527	0.064725	0.9484
D(HMC)	4.807810	4.237673	1.134540	0.2570
D(HMC(-1))	-0.245634	4.398978	-0.055839	0.9555
CONSTANT	2.331939	0.326460	7.143119	0.0000

4. Conclusion

The present study is based on finding the effect of Trade, Environmental Quality and Human Capital on Industrial Sector Output of 63 Developing Countries from 1990 to 2018. After checking stationary through Im, Pesaran and Shin W test, the Panel ARDL has been applied on the Panel data. The results of the study explain that Capital Stock, Money Supply, Price Level,

Government Expenditure and Human Capital are enhancing factors for Industrial sector output while labor force, Carbon Dioxide Emission and Trade Openness are reducing Industrial sector output.

The negative effect of CO2 needs to reduce by using efficient industrial machinery and taxation should be used to monitor properly in developing countries. It is suggested to update the means of production and to utilize them with efficiency so that the developing countries can increase the productivity by controlling CO2 and environment can be saved and sustained.

The negative effect of Trade Openness can be reduced by producing more quality products and to increase R&D activities not only finding the import substitute but also to introduce new product and process ideas for international markets. In addition, industrialists must be encouraged to produce the import substitute's product so that the gap of import and export can be reduced.

Capital Stock should be increased with some restrictions so that it continues to contribute in industrial value added. The restrictions must be imposed relating the extension of industrial sector not at the cost of agricultural land. The industrial sector must be located in uncultivated areas so that agriculture value addition remains unchanged. In Industrial Value Addition model, Labor Force is causing a reduction and it is required to provide the skills by vocational education that makes them to perform according to demand of the industrial sector efficiently in developing countries.

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