Analyzing the Push Factors of Brain Drain in Pakistan

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Abstract

Brain drain is the emigration of skilled labor from the home country to the host country due to socioeconomic and political factors. This study focuses on push factors responsible for brain drain to twenty seven destination countries from Pakistan. The study uses the annual time series data from the year 1976 to the year 2020. The theoretical framework for this study is based on the Neoclassical Theory of Migration and the Push-Pull Theory of Migration. The independent variables of the study are investment expenditure, political stability, real effective exchange rate, unemployment rate, and wage differential. Data is collected from World Governance Indicators, 2022, and World Development Indicators, 2022. According to the Augmented Dickey Fuller (ADF) test, all the variables are stationary at first difference. According to the results of co integration test, investment and real effective exchange rate have negative insignificant effects, while political stability has negative significant impact; unemployment and wage differential have positive significant effects on brain drain from Pakistan. The long run results of brain drain model are in line with economic theory and supported by earlier studies. The results of this study suggest that in order to handle the issue of brain drain in Pakistan, a policy directive may be developed to address unemployment, exchange rate management, and the poor environment for investment. This will ensure that the skilled workforce is used domestically, which will improve the country's economy as a whole.

Keywords: Brain drain, Push factors, Unemployment rate, Wage differential, Pakistan.

Introduction

According to the Bureau of Emigration and Overseas Employment, Government of Pakistan, more than 7 million Pakistanis live and work abroad. The loss of these people from Pakistan's labor force could have passive consequences for the development and economy of the country. Brain drain is the migration of skilled labor force from home country to destination country. There is a need to study the reasons for the emigration of skilled labor from Pakistan. Hashmi et al., (2012) stated that political and economic changes caused intellectuals in all fields of knowledge to migrate away from their home countries and towards the United States, Europe, Japan, and America. People move from their home country to another country due to higher wage earnings and a better quality of life, a secure career and personnel development, political stability,

and push factors such as a low standard of living, political-economic unrest, and unemployment (Mohamed & Abdul-Talib, 2020). A developing country like Pakistan spends huge amounts on providing infrastructure, training, and education to its people, but unfortunately, these highly skilled and educated people prefer to leave Pakistan due to both pull and push aspects. Due to various social, economic, political, and law and order reasons, brain drain has become a distressing situation for Pakistan (Mahmood, 2019). In developing countries, push factors dominate over pull reasons; therefore, the present study examines the push factors responsible for brain drain from Pakistan.

Brain Drain

Brain drain is a slang term that indicates a substantial emigration or migration of individuals. A brain drain can result from turmoil within a nation, the existence of favorable professional opportunities in other countries, or a desire to seek a higher standard of living. According to the **Cambridge Dictionary**, brain drain is the process by which a significant portion of highly educated and competent individuals leave their home country in search of better income and working circumstances abroad.

Brain drain is a situation in which many educated or professional people leave a particular place or profession and move to another one that gives them better pay or living condition **(Brittanica Dictionary Definition).**

A change of permanent residence is called migration. Internal migration is defined as a change of permanent residency beyond the bounds of a specific region, and external migration is defined as people moving from one country to another. The term "brain drain" refers to the external migration of educated and talented people (Asgari, 2011). Brain drain can be defined as a one-way movement of scientific ideas across countries, with the greatest benefit for developed countries (Gibson & McKenzie, 2011). Brain Drain may have negative consequences such as a reduction in the country of origin's growth capacity, a loss of taxes as labor leaves the country, and a reduction in the country's ability to adopt new technologies. Remittances are a good example of a positive effect. In this case, developed countries benefit from the brain drain at the cost of developing countries. International migration results in an increase in the stock of human capital known as brain gain (Kone & Ozdan, 2017).

Brain drain, or emigration, is the migration of highly qualified people from their home country to another country in search of better life standards (Mohamed & Abdul-Talib, 2020; Khalid & Urban ski, 2021). Through brain drain, a country loses its most highly educated, skilled, and talented workers. Thus, their expertise and skills are used in the economic development of host country. In developing countries, social openness to international migration might cause a highly skilled workforce to migrate, causing a brain drain issue; however, at the same time, it might boost the return on human capital (Abbas & Guriro, 2018).

Brain drain is also characterized as people moving from their home country to another country for a variety of reasons, including higher wage earnings and a better quality of life, secure career and

personnel development, and political stability. There are other push factors for developing countries, such as low standard of living, political-economic unrest, and unemployment (Yang et al., 2004).

Brain drain is a significant issue for developing countries. If brain drain is handled correctly, then it is beneficial in the form of brain gain. Source countries face the human capital flight of highly talented labor. Highly skilled migrants obviously remit more than low skilled migrants in order to reap the benefits of brain gain. There is a financial consequence of a brain drain to underdeveloped countries. Because migrants bring their abilities with them, the education and training they attained in their native countries and depart to host countries. As a result, the competence of these migrant workers aids the economic development of a foreign country, which is not favorable to the developing countries (Abdelbaki, 2007 & Grecu and Titan, 2016).

Both developing and developed countries can benefit from brain drain in terms of social, institutional, and cultural advancements. A mechanism should be devised so that the gains from emigration and immigration are distributed among the source and host countries. For this purpose, some policy guidelines are necessary to convert the huge brain drain into beneficial brain gain. According to (Siar, 2011), this practice was successfully done by China and Taiwan in attracting their emigrant skilled professionals to return and participate in the development of their countries. Abbas and Guriro (2018) specified that the brain drain from Pakistan is caused by economic, societal, and political reasons. Graduates are motivated to leave their home countries by their perceptions of good salaries, a high standard of living, peace, and a better future for their children. Findings from the study might help the government and decision-makers to pinpoint the actual causes of highly qualified graduates leaving the country and develop strategies to keep its skilled labor force in country.

Hashish and Ashour (2020) studied the determinants and mitigating factors responsible for the brain drain among nurses in Egypt. A purposeful sample of 35 nurses was interviewed in a semi-structured interview to gather exploratory viewpoints on the issues driving brain drain and mitigation techniques. According to the results, most of the brain drain among nurses is due to both push and pull factors, respectively. Among them, economics and the workplace were important. They suggested that policymakers may design a system that would enhance working conditions in order to stop the brain drain of nurses.

Feroz et al. (2021) considered that the fundamental reasons for the emigration of skilled labor include the typical push factors of inflation, unemployment, and an increased capital share in GDP. According to the findings, in order to limit the exodus of skilled employees from one country to another, socioeconomic environments should be improved and GDP per capita should rise. Unemployment and inflation should decline.

Rasheed et al., (2022) examined the macroeconomic determinants of emigration from India to the United States of America. The results revealed that while population density and human capital development both favored emigration from India to the United States in the short and medium terms, India's economic growth was able to limit it. The study offered a series of regulations for discouraging brain drain and inspiring brain gain based on such findings.

Vakili and Mobini (2023) analyzed the causes and contributing elements of the brain drain in Iran. The findings indicated that mostly emigration was strongly influenced by increased income, the attractions of the nations of destination, the characteristics that made the country of origin unappealing, global trends, and factors that affected the person and family. Depending on the nation and economic and social trends, the influence of elite movements can be either beneficial or detrimental, or limitations on economic, social, and human progress.

Research Questions and Objectives

The study answers the following questions:

What are the push forces behind the brain drain from Pakistan? How do economic variables like the investment climate, unemployment, wage differences with respect to foreign countries, and exchange rate movement affect the brain drain in Pakistan? What part does a political element, such as political unrest, play in the nation's loss of highly qualified and competent workers?

(2). Give solid suggestions to handle this issue.

The following goals have been achieved by this study:

1. To evaluate the push factors responsible for brain drain in Pakistan.
2. To present policy suggestions on the basis of results of the regression model of this study.

Review of Literature

Pakistan exports a large number of highly trained workers, doctors, engineers, academicians, and technical experts to the Middle East, the United States, Canada, and other western countries (Bureau of Emigration and Overseas Employment, Government of Pakistan, 2020). Pakistan is facing the problem of rising brain drain due to existing push factors. These factors were examined and viewed by various economic theories, economists, and other researchers.

Brain Drain at International Level

Solimano (2002) proposed that the prospect of a high salary tempted citizens of developing nations to emigrate. He has emphasized that, in addition to hostilities, political unrest in the country of origin, and racial prejudices, there were other reasons that influence people's decisions to migrate. According to ILO (2006), adverse economic situation in countries of origins and increased job opportunities were supply side factors; immigration policies and attractive economic situations in destination countries were demand side factors responsible for emigration. Katseli et. al., (2006) discussed the push and pull variables that contribute to brain drain in OECD nations. They learned that higher standards of living, sound public policies, and income disparities are the forces that

attract labor migrants, whereas rapid population growth, a high unemployment rate, poverty, uncertainty, and poor economic conditions in home countries were the forces that cause to increase brain drain.

Ahmad et. al., (2008) conducted an analysis of time series data to pinpoint the causes of Pakistan's brain drain. The findings revealed a favorable correlation between migration and the unemployment rate, and the same case was true for inflation. Inflation had a favorable effect on brain outflow, but there was a negative association between the real wage rate and brain drain. Kainth (2009) explored the reasons that drove people to migrate, which were almost nonexistent in developing nations but easily accessible and attainable in destination countries. These pull factors are improved economic situations, attractive salaries and earning opportunities, career improvement, excellent job prospects, an advanced research environment, a standard system of education, intellectual liberty, good working environments, higher employment, political stability, and the existence of irrational scientific and social custom.

Iravani (2011) reviewed the problem of brain drain. He stated that brain drain, also known as human capital flight, is the mass exodus of people with technical knowledge or skills, usually as a result of conflict, a lack of opportunity, political unrest, or health problems. Since emigrants typically took a portion of the value of their government-sponsored training with them, brain drain was seen as an economic expense. The movement of financial capital results in capital flight.

Docquier and Rapoport (2012) conducted a highly regarded and academic assessment of the scope, severity, spatial distribution, and causes of brain drain to underdeveloped and developed nations. They used data from the branches of knowledge such as, anthropology, demography, economics, geography, political science, and sociology. Ngoma and Ismail (2013) examined the factors responsible for the emigration of skilled labors from 102 developing countries. They applied descriptive statistics for analyzing the nature of the data and techniques of ordinary least square for long run estimates. The results showed that wage differentials have positive effects, and population size, political stability, government effectiveness, distance from source to destination countries, and expenditure on education have negative impacts on the emigration of labors from the selected countries of this study.

Chigozie (2014) identified the push and pull aspects influencing the brain drain of faculty and staff from Nigerian universities to industrialized nations. He concluded that low wages, unemployment, and ineffective leadership drive employees to other nations. Sulaimanova and Bostan (2014) employed the gravity model of migration to empirically examine the factors that contributed to emigration from Tajikistan and Kyrgyzstan between 1998 and 2011. It also gave empirical evidence on factors that influence international migration from the viewpoint of a source country. The study's conclusions showed that economic factors like GDP per capita, real wages, the value

added per worker in agriculture, remittances, exchange rates, and demographic factors like the size of the labor force have an impact on people's decisions to emigrate.

Brettell and Hollifield (2015) conducted an interdisciplinary examination of international migration in the social sciences. They claimed that deprivations, natural disasters, and environmental change played a major role in the migration of the earliest people. Simpson (2017) summarized the factors responsible for the emigration of skilled labor. These included economic factors such as a low level of income, higher unemployment rate, higher taxes, and an increase in population growth. Non-economic factors comprised a poor system of health, the status of war, corruption, and natural calamities. Many researchers neglected conflict as an explanatory variable for migration, but it has many important implications. The pull determinants came from economic factors; these are greater demand for labor, attractive salaries, generous wellbeing advantages, the best system of health, steady economic development, advanced technology, less expense of living, law and order situation, political rights, and freedom. Using long run panel data from eight nations during the years 1980 to 2013, Abdelbaki and El-Sherbiny (2021) examined the key factors influencing the exodus of Egyptians. The gravity model of migration was estimated using the fixed effect estimation technique. The results of the study revealed that the main causes of the Egyptian brain drain included social and economic issues, low earnings and living standards, the growth of corruption, and a high rate of unemployment in Egypt.

Gabriel et al. (2022) focused on the econometric investigation of factors influencing the movement of Filipino workers abroad among various nations. They used correlation analysis, Tests for Multicollinearity, serial correlation, heteroscedasticity, normality, and regression analysis through ordinary least squares. According to the findings, Remittances, wages, and unemployment rates were found to be statistically significant and positively associated with the emigration of skilled labor to the Philippines.

Akyildiz (2023) tried to develop a model for potential causes of the brain drain from Turkey to the United States. According to the research, there is a causal association between the indices of income, education, and life expectancy and brain drain. Overall, it is certain that variables related to the economy, education, and life expectancy are the main causes of the brain drain from Turkey to the United States.

Brain Drain at National Level

Arouri et. al., (2014) scrutinized the reasons responsible for the brain drain from Pakistan. They found that economic growth and fiscal development have negative impacts on brain drain, while inflation, unemployment rate, and trade openness have a direct positive relationship with it. Using a log-linear regression analysis, Altaf et al., (2015) discovered that there was a positive correlation between unemployment and people leaving their country, particularly in Pakistan. Ali et al., (2015) reported the variables that are the main drivers of skilled workers leaving Pakistan and moving to other parts of the world. After analyzing the data, it was discovered that young

students from middle-class households frequently move abroad in order to pursue a standard education and improve their future prospects.

Farooq and Ahmad (2017) conducted an empirical analysis of the factors that have contributed to the 36-year emigration of highly educated and skilled labor from Pakistan to 27 foreign nations. The regression model used in this study was a mix of the pull and push factors of the gravity model of migration. According to the study, the main driving forces behind migration from Pakistan were both push factors related to Pakistan's demographic and labor market circumstances and pull factors such the higher socioeconomic situations in the host nations. The study also concluded that planned brain export needs to be corrected in order to replace unintentional brain-drain in a country like Pakistan that is overpopulated.

Laila and Fiaz (2018) addressed the effect of political instability, remittances, and unemployment on the issue of brain drain in Pakistan. Over the years 1980 to 2013, annual time series data was used. Data were collected from World Development Indicators (WDI) and the Bureau of Emigration and Overseas Employment (BEOE) Government of Pakistan, and polity IV. The results of this study showed that the three explanatory variables have a positive and long run link with brain drain i.e., emigration of skilled labor class. The data for Pakistan from 1990 to 2016 has been used by the study of Nawwaz et. al, (2022) to determine how unemployment, per capita Income, and governance affect migrant outflow. The study confirmed that the key drivers of migration are governance and unemployment. According to this research, unemployment promoted more migration, ceteris paribus, while GDP per capita and government effectiveness had negative and significant effects on migration. The study presented a recommendation for the current government apparatus to work together to maximize socioeconomic development by optimizing migration levels.

Nadir et al., (2023) analyzed the perception of medical professional about the brain drain and its effect on the health sector in Pakistan by conducting a cross sectional study. A sample of 420 undergraduate medical students enrolled for the academic year 2021-2022 at two distinct medical colleges in Pakistan was selected. A questionnaire was collected and analyzed through SPSS. The results suggested that 33 percent want to leave Pakistan due to low pay and long working hours. This survey found that one in three medical students intends to transfer abroad after graduating. In order to stop the brain drain, Pakistan's health officials must start campaigns to address the problems faced by medical students and practitioners.

Research Gap and Contribution of the Study

Brain drain can be halted by providing those with skills, professional possibilities, and opportunities to demonstrate their abilities. The migration process has different impacts on each country depending on its economic, social, and political situation. This is because different empirical studies of migration consider different factors. Lower pay, poor research and development facilities, and institutional quality, according to Hall (2005), were all factors contributing to the movement of scientists and researchers. Work possibilities, lack of job security,

partiality in job selection and better employment, health, and educational options accessible abroad, according to Haque and Chandio (2013), were the key factors for brain drain in Pakistan. Arouri et al., (2014) found that economic growth and fiscal development have negative impacts on brain drain and inflation, unemployment rate, and trade openness have direct positive relationship with it. Naqvi et al., (2017) highlighted that a lack of pharmacy infrastructure, security difficulties in the country, and a difficult pharmacy licensure exam were important push reasons for migration of pharmacy students. Kousari et al., (2020) found that brain drain from Pakistan was negatively affected by governance, infrastructure, financial stability, and the standard of living in the long run. But Social openness has no significant effect on labor mobility in the long run. The study of Nawaz et. al, (2022) aimed to determine how unemployment, per capita Income, and governance affect the emigration of skilled labor from Pakistan.

Due to poor socioeconomic conditions in Pakistan, push factors compel skilled labor to leave the country; therefore, there is a need to study them in detail. The literature review suggested that limited number of studies are available on effect of exchange rate movements, wage differential, and political stability on outflow of highly qualified labor, therefore, this seemed a research gap in this area which needs to be studied in detail to forestall loss of quality human capital developed by using scarce resources. The present study tries to cover this gap by the investigation. The current study endeavored to recognize and investigate the push factors responsible for the emigration of skilled labor (brain drain) in Pakistan. The study has presented some policy suggestions in order to handle the serious and alarming issue of brain drain. There are many other pull factors responsible for brain drain, but they were not included in this study and it may be investigated by other researchers.

Theoretical Framework

This research work regarding the investigation of push factors for brain drain is based on the basic theories of migration. These theories explain the reasons and motives behind migration. These are as follows:

Neoclassical Theory of Migration

The theory postulates that wage differences, employment opportunities, and migration costs between countries are the main reasons for migration. The migrating workers calculate the benefits and costs of migration before leaving their countries. If the expected benefits are greater than the costs, then they decide to migrate. (Todaro, 1976; Arango, 2000).

Push-Pull Theory of Migration

According to this, Demographic aspects such as population growth, economic reasons like unemployment, poverty, a low standard of living, and political instability in home countries were considered push factors for the emigration of labor. Higher standards of living, better employment opportunities, and a good economic and political environment in host countries were listed as pull

factors for migration. Datta (2002) opined that negative features in home country were named as push factors and attractive attributes of destination countries were called as pull factors.

Application of the Theories of Migration and Their Comparison

Neoclassical theory highlights the economic reasoning behind migration decisions, whereas push-pull theory accentuates the unfavorable elements and situations in the place of origin and positive aspects in foreign countries that motivate migration. The Neoclassical theory concentrates on economic factors, but the push-pull theory offers a wider perspective by taking into account both the origin and destination aspects. Combining the two theories of migration mentioned above can give a more thorough understanding of the push variables by taking into account both the economic and non-economic factors that affect migration decision-making. Application of the two theories in this this study together can provide important new insights into the intricate brain drain problem in Pakistan.

Methodology

Identification of Variables

The study has used annual secondary time series data, covering the time span from year 1976 to year 2020 to explore the push factors responsible for brain drain in Pakistan. Explanatory variables of this study are: Real Effective Exchange Rate, Political Stability, Wage Differential, Total Investment Expenditure as Percentage of GDP, and Unemployment Rate in Pakistan.

Measurement and Explanations of Variables

This study has proxied **Brain Drain** by taking the sum of emigration of highly qualified, highly skilled, and skilled labor from Pakistan. The study has used **total investment as percentage of GDP of Pakistan** as an explanatory variable. A number of definitions for the term investment are possible based on various philosophies and principles. It is a word that has a variety of applications. The investment, according to economists, refers to the means of producing the items that will be utilized to make other goods. Increase in volume of investment will discourage brain drain from Pakistan. **Real effective exchange rate (REER)** is equal to nominal effective exchange rate divided by an index of costs or a price deflator. (WDI, 2022). An increase in the real effective exchange rate or depreciation of local currency decreases the purchasing power of domestic currency, other things being equal. It is not good for skilled and highly qualified labors who want to migrate to other countries. Skilled labor is reluctant to go abroad, and in this case, brain drain is discouraged. WGI (World Governance Indicators, 2022) stated that **Political Stability and Absence of Violence/Terrorism** calculates perceptions of the possibility of political stability and resultant panic, violence comprising terrorism. According to methodology given in WGI (2022), the estimate for Political Stability ranges from -2.5 to 2.5. Negative value shows that political stability and government performance are weak, which encourages brain drain, while positive value shows strong political stability and strong government performance, which discourages brain drain**. Unemployment rate** is calculated as the ratio of total number of unemployed labors to total

number of labor force multiplied by one hundred. Increase in unemployment results in an economic adverse situation, skilled labor force finds themselves uncomfortable in home countries, so, brain drain will increase. Wage is a monetary reward for mental and physical work of labor and differential means difference. So, **wage differential means** difference between wage in Pakistan and wages in destination countries. Higher wages in developed countries encourage skilled workers to migrate from their home country. These differences in wages lead to a positive effect on emigration. Wage differential is expected to have a positive impact on brain drain. As data regarding wage differential are rare and unachievable, therefore, this study has used GDP per capita of Pakistan divided by GDP per capita of twenty-seven countries proxy for wage differentials; the formula was got from Beine et. al., (2001), Dulam and Franses (2015), Ngoma and Ismail (2013).

Data Sources

The data regarding **Brain drain** was derived from the Bureau of Emigration and Overseas Employment, Government of Pakistan, from 1976 to 2020, thus covering a period of forty five years. Data for the variable **total Investment as a percentage of GDP** came from TCdata360, The World Bank, and Data Set: IMF-World Economic Outlook. The data on the **real effective exchange rate** was obtained from http://www.bruegel.org. (Data set of the real effective exchange rate for 178 countries: a new data base). **Political Stability** data came from WGI (World Governance Indicators, 2022). Data on the **unemployment rate** was drawn from World Development Indicators (WDI.2022). Data regarding Wage differential based on GDP Per capita in Pakistan and destination countries, and the source for the same was World Development Indicators **(**WDI, 2022**).**

Model Specification

Based on the studies of Marfouk (2007), Abdullah & Hossain (2014), Ali et al., (2015), Jozsa, et al., (2017), Laila & Fiaz (2018), and Reissova et al., (2021), the following model was estimated for examining the push factors of Brain Drain.

Brain Drain = f (Investment Expenditure, Exchange Rate, Political Stability, Wage Differential, Unemployment) ----------(1)

The econometric form of equation (1):

$BD = \alpha 0 + \alpha 1\ INVEST + \alpha 2\ REER + \alpha 3PS + \alpha 4\ WGD + \alpha 5\ UNEM + \mu$ -------(2)

Where,

BD = Total number of highly qualified, highly skilled, and skilled emigrants from Pakistan.

INVEST =Total investment expenditure as a percentage of GDP of Pakistan.

REER= Real Effective Exchange Rate Index of Pakistan. It is calculated by dividing the nominal effective exchange rate (measure of currency's worth against a weighted average of many currencies) by a price deflator or cost index (WDI, 2022).

PS = Political Stability in Pakistan.

WGD = Wage Differential in percentage, which can be calculated as:

$$WGD = \frac{\text{GDP Per Capita of Pakistan}}{\text{GDP Per Capita of Destination Countries}} \times 100$$

UNEMP = Unemployment rate in Pakistan.
μ = Standard error term and unexplained variation of the regression model.
Log– Lin form of equation (2) as under:
LBD = α0 + α1 INVEST + α2 REER + α3PS+ α4 WD + α5 UNEM + μ -----(3)
α0 is intercept, may take positive or negative value. α1, α2, α3, α4, α5 are slope coefficients of INVEST, REER, PS, WGD, and UNEM respectively. Where, $\alpha1 < 0$, $\alpha2 < 0$, $\alpha3 < 0$, $\alpha4 > 0$, & $\alpha5 > 0$.

Estimation Methodology

This study examined the push factors of brain drain in Pakistan. In order to explore the mentioned objectives, the study has utilized the descriptive statistics to discuss the nature, normality of data by using the values of mean, median, mode, skewness, kurtosis, and Jarque bara. The study computed the correlation matrix for checking the existence of multicollinearity among variables. To examine, whether a time series has a unit root, this study has used Augmented Dickey Fuller unit root test. To discover the long run association among variables, the study has used the Johansen's cointegration test. If it has been found that long run relation among variables exists i.e. variables are cointegrated with each other, of course, in the short run there may be disequilibrium. Therefore, (ECM) error correction model has been estimated to find out the short run fluctuations, past disequilibria and speed of adjustment. This study has used time series annual data, therefore, time series technique i.e. descriptive statistics, correlation analysis, checking stationarity of the data, co integration test, error correction model have been applied.

Results and Discussion

This section consists of the following sub headings:

Descriptive Statistics

In order to check the normality of data or normal distribution of data, this section has calculated various descriptive statistics and Jarque -Bera Statistic for each variable of brain drain model.

Statistical Analysis

The following table displays descriptive statistics for the variables used in model. This also determined the normality status of data used in this study.

Table 1: Descriptive Statistics & Normality Test for Model (Brain Drain)

	LBD	INVEST	PS	REER	UNEMP	WGD
Mean	11.47052	17.55186	-1.580772	134.6523	3.929544	6.811551
Median	11.25152	17.711	-1.549046	118.4638	4.12	5.594849
Maximum	12.95431	20.821	-0.339719	237.4876	7.83	12.50304

Minimum	9.767152	14.121	-2.810035	96.48924	0.4	3.90435
Std. Dev.	0.752211	1.621175	0.714463	43.51385	2.062746	2.584708
Skewness	0.295035	-0.194723	-0.138754	1.086432	-0.045981	0.592603
Kurtosis	2.451232	2.20351	1.907113	2.597129	2.25528	1.949965
Jarque-Bera	1.217493	1.473871	2.3839	9.156825	1.055745	4.701161
Probability	0.544032	0.478578	0.303629	0.010271	0.589858	0.095314
Sum	516.1733	789.8337	-71.13472	6059.354	176.8295	306.5198
Sum Sq. Dev.	24.89615	115.6412	22.4601	83312.02	187.2165	293.9516
Observations	45	45	45	45	45	45

Sources: Author's own calculations

The above table 1 calculates descriptive statistics such as mean, median, standard deviation, skewness, and kurtosis. The mean is the average value of a series; the median predicts the middle value; the maximum is the greatest value; and the minimum is the lowest value. The standard deviation is the dispersion of data from the sample mean. The measurement of the peakness or flatness of observations in data is called Kurtosis. Skewness is the status of asymmetry in data. As the above table shows, besides the variable political Stability, all other variables in the model are normally distributed. The decision rule for a normal distribution is that the mean value should be greater than its standard deviation.

Jarque-Bera Test/Statistic

This test also talks about the normality of data. The above table 1 shows the values of Jarque-Bera statistic and their probabilities for each variable. In the table, the probability values for the variables are 0.544032, 0.478578, 0.303629, 0.589858, 0.095314, and 0.010271 respectively. For the first five variables the probability values of the test are greater than 0.05, so, null hypothesis of normal distribution is accepted. The sixth variable REER (Real Effective Exchange Rate) has the probability value equal to 0.010271, which is less than 0.05. Alternative hypothesis of non-normal distribution is accepted for the said variable.

Correlation Analysis

The following table is showing the correlation values for variables of model.

Table 2: Multicollinearity Test for Model (Brain Drain)

	LBD	**INVEST**	**PS**	**REER**	**UNEMP**	**WGD**
LBD	1.000000	-0.523128	-0.798916	-0.572126	-0.122428	-0.703347
INVEST	-0.523128	1.000000	0.320405	0.273919	0.024767	0.476591
PS	-0.798916	0.320405	1.000000	0.743338	0.335454	0.805647
REER	-0.572126	0.273919	0.743338	1.000000	-0.082007	0.926527
UNEMP	-0.122428	0.024767	0.335454	-0.082007	1.000000	-0.003298
WGD	-0.703347	0.476591	0.805647	0.926527	-0.003298	1.000000

Sources: Author's own calculations

The above table 2 shows that the values of all correlation coefficients of the variables are less than 0.9; it means that there is no multicollinearity among variables of the model (Aestreriou & Hall, 2016).

Unit Root Results

A variable contains unit root if it is non-stationary. Most of economic time series do not fulfill the assumption of stationarity, so, it is called non-stationary time series. In this case regression produces spurious and invalid results. In order to circumvent invalid regression results, stationarity test will be applied on each variable of the study. This study has used the ADF test in order to check the presence of unit root in each variable. The ADF test was tested on the basis of following hypothesis; (Null will be tested against alternative)

Null hypothesis (Ho: Data regarding a variable is non- stationary.

Alternative hypothesis (H1: Data regarding a variable is non- stationary.)

Generally, the lag length of ADF tests determined on basis of AIC (Akaike Information Criteria) and SBC (Schwartz Information Criteria). The results of ADF for this study were computed by using computer software Eviews 9.

ADF Result at Level

The following table shows the unit root estimates for each variable of the model.

Table 3: ADF Test Results at Level ($\alpha = 0.01$)

Variables	**Test Equation**	**ADF Test Statistic**	**Critical Values at 1 %**	**Result**
Brain Drain (LBD)	With Intercept	-1.756441	-3.588509	Non stationary
	With Trend & Intercept	1.390056	-2.618579	
	With None	-3.332862	-4.186481	
Political Stability (PS)	With Intercept	-1.778604	-3.588509	Non stationary
	With Trend & Intercept	0.290903	-2.618579	
	With None	-0.484520	-4.180911	
Investment as Percentage of GDP (INVEST)	With Intercept	-2.244637	-3.588509	Non stationary
	With Trend & Intercept	-0.339509	-2.618579	
	With None	-3.269024	-4.180911	
Unemployment Rate (UNEMP)	With Intercept	-2.316847	-3.588509	Non stationary
	With Trend & Intercept	-0.671092	-2.618579	
	With None	-2.296069	-4.180911	
	With Intercept	-1.157832	-3.588509	

Real Effective Exchange Rate (REER)	With Trend & Intercept	-1.677552	-2.619851	Non stationary
	With None	-1.054060	-4.180911	
Wage Differential (WGD)	With Intercept	-0.937753	-3.588509	
	With Trend & Intercept	-1.609693	-2.618579	Non stationary
	With None	-1.771443	-4.180911	

Sources: Author's own calculations

The results in the above table 3 show that ADF test statistic values are greater than the critical values in three equations, therefore, null hypotheses are accepted and concluded that all variables of the model are non-stationary at level.

ADF Results at First Difference

ADF test was performed for the regression model at first difference and results are given in following table.

Table 4: ADF Test Results at First Difference ($\alpha = 0.01$)

Variables	**Test Equation**	**ADF Test Statistic**	**Critical Values at 1 %**	**Result**
Brain Drain (LBD)	With Intercept	-5.634063	-3.596616	Stationary
	With Trend & Intercept	-5.576590	-4.192337	
	With None	-5.453843	-2.621185	
Political Stability (PS)	With Intercept	-4.907564	-3.592462	
	With Trend & Intercept	-5.174927	-4.186481	Stationary
	With None	-4.869709	-2.619851	
Investment as Percentage of GDP (INVEST)	With Intercept	-7.972669	-3.592462	
	With Trend & Intercept	-7.960831	-4.186481	Stationary
	With None	-8.057107	-2.619851	
Unemployment Rate (UNEMP)	With Intercept	-6.397629	-3.592462	
	With Trend & Intercept	-6.319396	-4.186481	Stationary
	With None	-6.450397	-2.619851	
Real Effective Exchange Rate (REER)	With Intercept	-5.127214	-3.592462	
	With Trend & Intercept	-5.151142	-4.186481	Stationary
	With None	-4.930422	-2.619851	
	With Intercept	-6.674394	-3.592462	

Wage Rate Differential (WGD)	With Trend & Intercept	-6.798465	-4.186481	Stationary
	With None	-6.674394	-2.619851	

Sources: Author's own calculations

The results in the above table 4 show that ADF test statistic values are less than the critical values of one percent in three equations, therefore, null hypotheses are rejected, alternatives are accepted and concluded that all variables of the model are stationary at first difference at 1 percent significance level. Order of integration of each variable is equal to one and numerically it can be written as 1(1).

Lag Length Selection Criteria

Before testing cointegration among variables, the lag structure of VAR (Vector Autoregressive Model) is to be determined. The test was performed with the help of computer software EViews at lag three and lag two. The results show that SC (Schwarz information criterion) and HQ (Hannan-Quinn information criterion) are minimum at lag one with lag order three while, AIC (Akaike information criterion) has smallest value at lag 2 with lag order two. So, lag order of two on the basis of AIC, is selected for VAR model.

Selection of VAR Model for Brain Drain

This study has selected VAR model on the basis of Akaike Information Criteria (AIC). In EViews 9, cointegration test was performed with lag two, according to five assumptions and option number six summarizes results of all five set of assumptions. Click option six and it will give results about Information Criteria, AIC is minimum in VAR model of assumption number four and SIC is minimum in VAR model of assumption number one. This study has selected VAR model on basis of AIC i.e., the model of assumption number four and taking two as lag of VAR.

Unrestricted Cointegration Rank Test (Trace Statistic)

Johansen Cointegration test was performed for determining the number of cointegrating vectors among variables by using Trace Statistic and Max- Eign value. According to Trace Statistic, two cointegration equations exist among variables at the five percent probability level. According to Max-Eigen statistic, one cointegration equation exists among variables at the five percent probability level. Therefore, the study has used one cointegrating vector in order to build the long-run relationships among the variables.

Long-run relationship

Johansen Cointegration test was applied in order to determine the long run relationship among dependent and independent variables or find the slope coefficients of independent variables of this study. Following are the long run coefficients/Normalized estimates for regression model.

Table 5: Johansen Normalized Estimates

Variables	Coefficients	Standard Error	T-Ratio

INVEST	-0.008801	0.03250	-0.27079
PS	- 0.637481	0.17016	-3.74630
REER	- 0.002120	0.00235	-0.90132
UNEMP	0.087148	0.02820	3.09028
WGD	0.365439	0.05078	7.19687

Sources: Author's own calculations

In the above table, the coefficients signify estimate of long run elasticities of brain drain with respect to investment as percentage of GDP of Pakistan, Political Stability in Pakistan, Real Effective Exchange rate of Pakistan, Unemployment rate in Pakistan, and Wage Differential for Pakistan. From the table, the econometric form of Brain Drain Model takes the following log ln form:

LBD = - 0.008801INVEST- 0.637481PS - 0.002120 REER + 0.087148 UNEMP +0.365439 WGD ----------(4)

In equation (4), LBD is log of Brain Drain from Pakistan to the rest of the world proxied by taking sum of emigration of highly qualified, highly skilled and skilled labor force. All variables have corrected sign. Regression results are significant for variables PS, UNEMP, WGD. For variables INVEST, REER have insignificant effect on brain drain, because t-values for these two are less than one. Followings are interpretations of results for equation (4):

Brain Drain and Investment (INVEST)

According to table 5, investment in Pakistan affects brain drain negatively. The result for this variable has correct respective sign. Investment means increase in capital stock, which ultimately leads to boost employment. Thus, with increase in investment the skilled labor force will get employment domestically and there will be less volume of brain drain from a country. It means that increase in investment will lead to decrease the number of skilled labors who go abroad. Negative relationship exists between brain drain and investment. This result is supported by the study of Doghri et al. (2006). The result shows that investment expenditure in Pakistan has an insignificant effect on brain drain in Pakistan. Volume of investment is low due to the higher interest rate that is why it has insignificant effect on brain drain in Pakistan.

Brain Drain and Political Stability (PS)

According to (WGI) World Governance Indicators, Positive value for coefficient of political stability shows strong political stability while negative value means weak political stability. According to results given in the table 5, coefficient for PS is - 0.637481. It shows that political stability in Pakistan negatively affected brain drain. The coefficient of parameter PS is consistent with push- pull theory of migration and statistically significant. When there is a political stability that is strong govt exists in a country, brain drain is discouraged because skilled labor finds internal situation favorable and they do get job inside the country. The findings of Sajjad (2011); Khan et

al., (2012); Ngoma and Ismail (2013); Jozsa, et al., (2017); Laila and Fiaz (2018); Reissova et al., (2021), Reissova et al., (2021) justified the result of this study for political stability.

Brain Drain and Real Effective Exchange Rate

The coefficient for REER is - 0.002120, showing that brain drain is affected by exchange rate negatively. The coefficient for this variable has correct respective sign. Increase in real effective exchange rate depreciation of local currency decreases purchasing power of domestic currency, other things being equal. It is not good for those skilled and high qualified labor who want to migrate to other countries. skilled labor is reluctant to go abroad and in this case brain drain is discouraged. Decrease in real effective exchange rate increases purchasing power of domestic currency. It becomes beneficial for those skilled and high qualified labor who wants to migrate to other countries. In this case brain drain has encouraged. It can be explained by another way. This result is consistent with views of the studies done by Sulaimanova and Bostan (2014); Shin (2021). This finding also shows that the real effective exchange rate of Pakistan has an insignificant effect on brain drain due to the existence of other more significant and structural factors that affect the emigration of skilled labor.

Brain Drain and Real Unemployment Rate

The coefficient for variable Unemployment is 0.087148. it means that unemployment rate affected brain drain positively. Result is matched with push- pull theory of migration and statistically significant. The finding of Laila and Fiaz (2018) matched with the result of this study. When unemployed skilled labor is unable to get job in their own country, this compel them to leave the country for search of job in foreign country because there are certain countries which warmly receive and welcome the skill labor. These countries get the labor at zero cost. So, in case of increase in unemployment, brain drain is also increasing in order to get right job in foreign country. A fall in unemployment rate will increase employment opportunities in their domestic countries, so brain drain will reduce. The finding also matched with the result of Ahmad et al., (2008); Haider & Hussain (2011); Khan et al., (2012); Arouri et al., Akusoba (2014); Chigozie (2014); Ahad (2015); Simpson (2017); Adovor et al., (2021) Nawaz et al., (2022); Gabriel et al., (2022).

Brain Drain and Wage Differential

Wage Differential is defined as a ratio of GDP per capita of domestic country and GDP per capita of source country multiplied by 100.The coefficient for the variable WGD is 0.365439, which is statistically significant and consistent with neo classical theory of migration. If there is an increase in wage differential with respect to foreign destination countries, skilled labor in domestic countries find it beneficial and will migrate to those countries. Thus, increase in wage differential will boost brain drain. If there is decrease in wage differential, skilled labor will feel reluctance to move towards the destination countries and hence brain drain will reduce. The findings of Solimano (2002); Eggert et al., (2009); Kainth (2009); Fan and Yakita (2011); Sulaimanova and Bostan (2014); Dulam and Franses (2015); Ghazali et al., (2015); Naqvi et al., (2017); Abbas and Guriro (2018); Martin (2019); Gabriel et.al (2022) justified the result of this study.

Short Run Estimates

The following equation denotes the dynamic short run relationship:

$$\ln\Delta LBD = \beta o+\beta 1 \ln\Delta INVEST + \beta 2 \ln\Delta PS + \beta 3 \ln\Delta REER + \beta 4 \ln\Delta UNEMP + \beta 5 WGD + et\text{-}1 \quad \text{----------(5)}$$

In the short run at lag one, Investment, Political Stability, Real Effective Exchange Rate, Unemployment Rate have positive while Wage Differential has negative impacts on brain drain from Pakistan. At lag two, Investment has negative, while Political Stability, Real Effective Exchange Rate, Unemployment Rate, and Wage Differential have positive impacts on brain drain from Pakistan. All short run estimates are insignificant because t-values are less than two. The value of vector error correction term is equal to 0.135157 and has t-values 0.72906. it shows no short run disequilibrium.

Conclusions and Policy Implications

As Pakistan is a developing country, so, push factors are dominant. There is a need for investigation of the said factors of brain drain. the This study was conducted to enquire the problems of brain drain in Pakistan. The data were collected from various secondary sources, covering the time span from 1976 to 2020. Descriptive statistic and correlation analysis has been used for normality and multicollinearity status of the data of this study. The results of ADF test showed that all variables have become stationary at first difference; having order of integration equal to one. This justified the use of Johanson contegration test for further proceeding. Lag order of two on the basis of AIC, is selected for VAR model. This study has selected VAR model on basis of AIC i.e., the model of assumption number four and taking two as lag of VAR. percent. The results of trace statistic indicated that two cointegrating relationship exist between variables and maximal Eign value showed one cointegrating vectors at 0.05 level. But this study has used one cointegrating relationship in order to estimate the long run normalized estimate of brain drain model.

The results of Johansen's cointegration test specified that the variable **Total Investment Expenditure as Percentage of GDP of Pakistan** has affected brain drain from Pakistan negatively. This is understandable in the light of economic theory. Investment means increase in capital stock, which ultimately leads to increase employment opportunities. Thus, with increase in investment the skilled labor force will get employment domestically and there will be less volume of brain drain from a country. **Political stability in Pakistan** has negatively affected brain drain. This result is consistent with economic theory and statistically significant. When there is a political stability that is strong govt exists in a country, brain drain is discouraged because skilled labor finds internal situation favorable and they do get job inside the country. On the other hand, negative coefficient means weak political stability, leading to weak government and unfavorable circumstances in Pakistan; as a result, the skilled labor leaves the country.

Real Effective Exchange Rate of Pakistan brought a negative change in brain drain from Pakistan. Exchange-rate depreciation of the currency of Pakistan makes migration less

attractive for skilled labor. While appreciation of exchange rate increases the emigration of skilled labor from our country (Shin, 2021). According to economic theory, brain drain is discouraged by devaluation/ increase in exchange rate, because exports become cheaper in international market and encourages domestic production, causing an increase in investment and employment opportunities inside the country which lowers emigration of skilled labor.

Brain drain was positively influenced by **unemployment rate** in home country. Results are statistically significant and in line with economic theory and findings concur with those of Laila and Fiaz (2018). When skilled labors without jobs are unable to find employment in their own country, they are forced to leave because there are some nations that will warmly welcome and employ skilled labor. A fall in unemployment rate will increase employment opportunities in their domestic countries, so brain drain will discourage. **Wage differential** has positive effect on brain drain from Pakistan. The result is consistent with economic theory. If wage differential between home and overseas destinations widens, skilled workers in domestic countries will move there because they see the benefits. Increased wage disparity will hence accelerate brain drain. If there is decrease in wage differential, skilled labor will be reluctant to move to other countries and hence brain drain will reduce. All long run coefficients of each independent variable are in with economic theory.

Policy Implications

The study finds important policy variables that can be used to create sensible policies for handling brain drain in Pakistan. The conclusion of this study can be used to draw a number of policy directions. A set of the following suggestions based on the findings of this study, may be put before the policy makers.

(1) Policymakers in the country may take practical steps, like employing skilled and competent workers where they are needed because unemployment leads brain drain from Pakistan.

(2) According to findings of the study, policy guideline may be formulated for handling wage differential for controlling brain drain from Pakistan, so that the services of these skilled labor will be utilized inside Pakistan, having a positive impact on overall economic situation in the country.

(3) Level of investment may be encouraged in order to discourage brain drain from Pakistan.

(4) Civic sense, respect for job, self-esteem and self-respect may be promoted in the country.

(5) Management of exchange rate may be efficiently exercised and some regulations may be imposed.

(6) Social, industrial, and corporate sectors may realize their responsibilities in controlling brain drain.

Future Research Direction

Favorable pull factors in the destination countries encourage brain drain from Pakistan. Research works are available on a mix of push and pull factors but are limited to the pull factors of brain drain, return migration, and brain grain in the form of an increase in human capital in Pakistan.

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