Brain Drain: Causes, Effects & Factors affecting it

Dissertation submitted

by

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to

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Abstract:

The present study examines the possibility of finding measurable factors that influence the Brain Drain phenomenon. By collecting data for the period 1980-2010 every five years for 61 countries, the paper examines 5 possible factors as to whether they are statistically significant in the Brain Drain phenomenon. Based on the analyses made below, it appears that the variables GDP per Capita, Expenses on Education per capita and Population have a statistically significant effect on the dependent variable, as opposed to the Gini Index and Unemployment Rate variables, which do not show a statistically significant effect on the dependent variable. The final regression model, after receiving the data determined the final degree to which it can make an accurate prediction with the overall success rate being 22.12%.

Furthermore, the study explains what the "Brain Mobility" phenomenon is by dividing it into the categories "Brain Gain" and "Brain Drain". It then presents positive and negative effects, while a special reference is made to the case of Cyprus with several graphic representations and scatter plots that allow for a deeper analysis of the phenomenon and help to explain safer results.

1. Introduction:

The phenomenon known as "scientist leakage abroad" refers to the exodus of highly skilled individuals, primarily from less developed nations to more developed nations abroad. A person who was born outside of their nation of residence, is 25 years of age or older, and has an academic or professional degree, earned after completing secondary education is considered a highly competent individual (further education). (Marfouk and Docquier, 2006). If we calculate the number of highly educated individuals who were born and trained in a particular country and now reside and work in another, we can determine the amount of scientific potential that has leaked from that country (Lambrianidis, 2011 p. 17).

The mid-1800s and the early years of economic science both demonstrate an understanding of the role that human resources play in development. Human resources are one of the fundamental types of capital, according to Adam Smith (1776), who also notes that knowledge, training, and education are assets that benefit both the individual and society at large. Economic science and particularly neoclassical approaches have long undervalued or disregarded the role that human resources, particularly their qualitative attributes like education and skill play in the process of development (Curtezis, 2003).

Recent years have seen a rise in the popularity of "brain mobility," or the movement of researchers and postsecondary students, particularly in Europe, where it has become a significant component of higher education policies in many nations. The European Union (EU) created programs like the Marie Curie scheme for young researchers and ERASMUS for students to demonstrate the value it placed on mobility. Its global ERASMUS Mundus program just got underway. Significant European policy agendas, like the Lisbon and Bologna processes, also place a high value on international mobility. The same is true at the national level, where governments are operating bilateral programs for international mobility and have set policy objectives relating to mobility.

However, parallel to this perspective, there is, and has long been, a negative image of international mobility, or more specifically, of certain of its (alleged) consequences, which are associated with concerns about the "brain drain." While a formal definition of the phrase has never been established, it is widely believed to denote a consistent and significant net outflow of individuals from one nation to another. Large-scale "brain drain" has the potential to undermine a nation's scientific and higher education systems, as is apparently the situation in many emerging nations. Migration flows between affluent nations have often been referred to as "brain drain."

This paper will study the phenomenon of "Brain Drain" and will examine the main factors that determine and reproduce it. The paper will study 61 different countries and will consider the following 5 possible factors:

- "GDP per capita",

- "Unemployment Rate"

- "Population"

- "GINI index"

- "Expenditure on education per capita" (Public Labour Spendings on education per capita)

All variables will relate to the country of origin. The data will be collected every 5 years between the years 1980-2010.

Although there are lots of variables that might enhance this phenomenon, they are non-observable or non-measurable. These types of factors are referred to as the following:

- Dissatisfaction with the nation of origin's political leadership and administration.

- Forced relocation because of fighting or war.

- Migration because of family connections, etc.

- Globalization

- Access to worldwide information through the years

- Easier transportation through the years

All these factors, as well as many others, cannot be measured and included in the model regression and will therefore be included in the error.

On the other hand, even if the individuals possess the intellectual capacity to do so, there are instances in which many educated individuals decide against searching for a different nation that would theoretically provide them with better living conditions. The following are some of the factors that might influence their decision:

- Family conditions

- Fear of the unknown or/and failure

- Lack of funds

- Visa

In coherence, the research will discuss the potential effects of brain drain on both countries (origin and destination countries), where it will be enough emphasis on Cyprus where the Brain Drain phenomenon will be analyzed in more detail. More specifically, data such as:

- Detailed outputs of educated residents of the country to the 5 most popular destinations, both in total numbers and by sex.

- Detailed statistics of the unemployment rate over the years as well as the government spending per person related to the education of Cypriots, in an attempt to explain better why our compatriots tend to leave the country at an increasing rate, since based on the analyses that will follow, our country remains steadily among the top 5 countries with outflows of educated population from 1980 to 2010, for the countries studied by the survey.

2.Literature Review:

2.1 Historical Overview & Theoretical Background:

Most people equate "capital" with money, bank accounts, stocks in businesses, or real estate. Yes, all of these are assets that generate income over time and are thus kinds of capital, but capital may take many other forms as well.

One might think of knowledge and skills as types of capital. They are often expected to provide dividends over time, much like other assets. In terms of developing human capital, health care spending and education and training are viewed as essential expenditures. They produce private returns, meaning that they will eventually lead to improved employment, which will raise the incomes of the affected individuals. Furthermore, they are viewed as essential elements for the performance levels of national economies: better workforce education levels will, in this perspective, result in higher employment and economic growth. Such investment is considered more crucial now than in the past since growth in today's societies and economies is thought to be at a much higher level than in earlier ones driven by innovation and hence knowledge (known as "knowledge economies").

People's knowledge and abilities are what make them capital, therefore when they leave the nation where they received their education and training, that capital also departs; that is, the country of origin loses it, and the country of destination gains it. From the home nation's perspective, the money it had previously invested in the emigrant's education and training had been wasted. What was thought to be an investment ended up being just "consumption." It goes without saying that the loss is largest when a significant investment has been made, which is typically the case for the "highly skilled," and especially with researchers. Human capital is given as a gift to the destination nation. It has had a "brain gain," whereas the nation of origin has experienced a "brain drain." It should be noted that the terms "brain gain" and "brain drain" are often used in reference to significant migration and a

highly unequal balance of immigrants and emigrants over an extended period. Situations known as "brain exchange" or "brain circulation" are those in which a sizable number of people travel while maintaining a relative equilibrium.

The metaphor of "brain drain" in classical (economic) theory has never been entirely clear and has become entangled with political and ethical issues. The word seems to have originated in the early 1960s British scientists' emigration to the United States debate, which was triggered by British Royal Society records. In the framework of development policy, it improved and gained greater recognition in the late 1970s and early 1980s. In this discussion, the question was whether it was morally acceptable to acknowledge that the poor Third-World countries' investments in human resources greatly harmed the affluent industrialized countries' chances of economic and social growth.

Whether it was appropriate to refer to "brain overflow" rather than "brain drain" at all was a crucial topic of contention. Another school of thought, based on neoclassical theory, cautioned against any interventionist measures, while one, anchored in the economics of education, supported regulatory policies to restrict and channel migration between the developing and industrialized nations. It's clear that the argument about the benefits and drawbacks of the highly skilled population movement is still going strong today. Concerning the anticipated migration of academics and researchers from Central and Eastern Europe and the former Soviet Union to the West, a third wave of the "brain drain" controversy has begun.

More recently, the "brain drain" controversy has (also) resurfaced to address the (reported) departure of a significant number of highly qualified young European scientists to the United States, particularly in the natural sciences, engineering, and technology fields. Measures were implemented in parallel to (re-)attract highly qualified scientists to each of the European nations. A more positive interpretation of the phrase "brain gain" resulted from this concerted drive to "reverse "brain outflow." Although the metaphor of "brain drain"

emphasizes the loss of the weak, the image of "brain gain," which also refers to the same event, emphasizes the gain of the strong.

Another sign of a paradigm shift is the appearance of the "brain gain" concept. Whereas in the past guilt about appearances won out, pride in one's physical attractiveness has taken center stage more lately.

2.2 Potential effects of Brain Drain:

Scientific labour force is being leaked, and it pertains to the larger problem of migration from the least developed to the industrialized world. A significant portion of the often-scarce resources of the state and the community of origin have been allocated toward the loss of not just any segment of society but also its most educated segment. Thus, the mission society suffers a twofold loss. The loss of heavily invested capital results in both economic and human losses, as well as a reduction in society's capacity for progress and an increase in the gap between developed and developing nations (Lambrianidis, 2011, p. 44-45).

Transfers, the development of human capital, the diaspora network's influence on trade, Foreign Direct Investment (FDI) flows, the institutions of the destination country, and FDI are the primary avenues through which the leakage of scientific potential abroad impacts the economy of the mission country (Docquier and Rapoport, 2012, p.683). There are advantages and disadvantages for the countries of origin associated with the leaking of scientific professionals. The destination nations experience comparable favorable benefits. The following are two interconnected negative consequences on nations of origin (Straubhaar, 2000, p. 16):

1. Decreases in high skilled human capital, which results in the loss of one of the essential elements of future economic expansion. This accelerates the leakage

of scientific potential by lowering productivity in the countries of origin and providing more incentives for professionals to migrate to industrialized nations.

2. Losses of a sizeable portion of public funds used to develop migrants' human capital since those funds will be used by another nation.

Due to the increased human capital available, the influx of immigrants creates positive technical externalities in contrast to host economies (destination nations), hence widening the gap between affluent and poor countries (Lambrianidis, 2011 p. 49).

The exporting countries—often the least developed—are typically the losers in the phenomena of scientific capacity leakage, while the destination (or host) countries—typically the developed ones—unquestionably benefit. (Pages 17–46 in William and Balaz, 2008).

The productivity factor (TFP) of a nation of origin decreases because of the leakage of scientific potential (Schiff and Wang, 2008). Furthermore, the influence on productivity growth increases with country size. This is because smaller countries tend to have higher rates of scientist leakage and are more productively dependent on development than bigger nations.

Money transfers, or the money transferred by migrants to their country of origin, have a well-established positive impact on nations of origin (Docquier and Rapoport, 2005; Bank of Greece, 1966, pp. 12). provides society with a measure of equal recompense for the losses incurred by the departure of its most productive human capital and the decline in the value of its educational investments. Immigrant transfers from outside can lower financial barriers to investing in natural and human resources and are a significant source of revenue in developing nations. An estimated $100 billion or more is transferred annually by migrants, with over 60% of that amount ending up in less developed nations. Regardless of educational

attainment, the primary drivers behind immigrants' transfers are the need to support their families back home and to be ready for their return (Lambrianidis, 2011, p. 55).

Due to the increased amount of human capital that is accessible, the influx of immigrants creates positive technical externalities in contrast to the host economies (destination nations), hence widening the gap between affluent and poor countries (Lambrianidis, 2011 p. 49). This has the effect that the destination countries accelerate their growth rates, speed up and improve the quality and speed of their R&D, which will bring multiple benefits to the economy, the standard of living and in multiple aspects of the overall development of a country.

2.3 Evidence Base:

As mentioned above, the 5 main factors that will be examined are: "GDP per Capita", "Unemployment Rate", "Population", "Gini Index'' and ""Expenditure on education per capita" (Public Labour Spendings on education per capita)". In this sector it will be analyzed why these factors are the main topic of the research, according to the bibliography.

GDP per Capita:

The first factor to be examined is the "GDP per Capita". According to Mr. Antonios Panagiotakopoulos' research, "Investigating the factors affecting brain drain in Greece: looking beyond the obvious," at the University of East Anglia in Norwich, UK, states that the biggest reason why the brightest minds leave their home country is dissatisfaction with the political leadership and administration. Mr. Panagiotakopoulos discovers that about 70% of the individuals who departed the nation stated that their extremely dire economic circumstances resulted from the government's poor decisions, which included low GDP per capita, excessive taxes, and a severe lack of investment in public education.

According to Frédéric Docquier's article, ("The Brain Drain from developing countries") at the Université Catholique de Louvain, and National Fund for Scientific Research, Belgium, and IZA, Germany, moving toward the favorable equilibrium might result in a more than 100% rise in salaries and GDP per capita in poorly coordinated nations with low GDP per capita. The probability of a coordination failure in the event of a recent mass brain drain from the nation and a stable excellent equilibrium is contingent upon the degree to which individuals depart from the previous good equilibrium in reaction to unfavorable shocks in the recent past. Due to their higher sensitivity to economic shocks, migration from small nations is far more likely to be ill-coordinated. Appropriate development measures are needed for these little nations, such short-term financial aid for highly trained foreigners to return home.

The expected result is the bigger the GDP per Capita of a country is, the lowest the Brain Drain from the country.

Unemployment Rate:

In their study "Unemployment and Migration: Does Moving Help?" Sari Pekkala and Hannu Tervo "A case study comparing Finland's brain drain outflows to the nation's unemployment rate" was conducted at the University of Jyvaskyla in Helsinki. The findings indicated that individuals seeking work are likely to relocate from high-unemployment areas if they are unable to obtain employment. On the other hand, people go toward areas with low unemployment rates since they provide better chances of employment; refer to Greenwood (1975) and Molho (1986). Therefore, it is important to note that, on an individual basis, jobless people are likely to relocate if they believe their prospects of obtaining employment there are better than where they were before (DaVanzo, 1978; Schlottmann and Herzog, 1981; and Boehm et al. (1998).

The expected result is the bigger the Unemployment Rate of a country is, the bigger the Brain Drain from the country.

Population:

Frédéric Docquier, Olivier Lohest, and Abdeslam Marfouk, published their research "Brain Drain in Developing Countries" to The World Bank Economic Review, 2007, Vol. 21, No. 2 (2007), pp. 193-218 Published by: Oxford University Press. They presented a deceptive outcome for the nation's populace. The rationale is that although smaller nations are likely to lose a larger percentage of their inhabitants even though they lose fewer individuals, larger countries are likely to lose a larger amount of people. Their principal outcome was as follows: "The average emigration rate is higher in small countries than in large countries." Small and developing nations that transfer most of their immigrants to nations with merit-based immigration laws experience a greater brain drain. It should come as no surprise that tiny nations that are near to important OECD areas, have colonial ties to OECD nations, and transfer most of their immigrants to nations with quality-selective immigration policies experience a significant brain drain.

The expected result is the bigger the Population of a country is, the bigger the Brain Drain from the country (as numeric number and not as a percentage of the population).

"Expenditure on education per capita" (Public Labour Spendings on education per capita):

The study "The Elite Brain Drain" by Rosalind S. Hunter, Andrew J. Oswald, and Bruce G. Charlton Source: at the Economic Journal, June 2009, Vol. 119, No. 538, Features (June 2009), pp. F231-F251 Published by: Oxford University Press on behalf of the Royal Economic Society, discusses brain drain and places a strong emphasis on research and development across all nations. They revealed that people move in a methodical manner in the direction of countries that invest much in R&D. The study finds that scientists who

migrate and those who stay have the same h-index citation ratings, but it is unable to conclude if migration increases scientists' output. Compared to past times, immigrants in the US and UK now receive Nobel Prizes at a substantially lower rate. The h-indexes of Americans are comparatively high. They present a framework in which reduced mobility costs in the contemporary world play a crucial role.

The expected result is the more a country spends on education and R&D of the individuals, the smaller the Brain Drain from the country.

GINI Index:

A statistical dispersion metric known as the Gini index is used to quantify income, wealth, or consumption disparity within a country or social group. The inequality between the values of a frequency distribution, such as income levels, is measured by the Gini coefficient. A Gini coefficient of 1 (or 100%) indicates extreme inequality among values, which is the case when one person has all the income and everyone else has none. A Gini coefficient of 0 represents complete equality, when all income or wealth values are the same.

Literature is divided into this specific indicator. Many argue that the greater the inequality in a country, the more likely it is for its scientists to abandon it. This statement comes to be contradicted by the argument that yes although there may be a large proportion of inequality in the country, however the logic says that the highest proportion in the highly paid workforce will be held by these people since they are highly skilled in knowledge.

The main sources for collecting data and creating the database are websites such as:

- IAB Institute (Institut für Arbeitsmarkt- und Berufsforschung der Bundesagentur für Arbeit KdöR) – Collected the main data for inflows. The IAB brain drain data on international migration covers information for 20 OECD destination countries by gender, country of origin and educational level

for the years 1980 to 2010 (5-year intervals). - https://iab.de/en/daten/iab-brain-drain/

- World Bank Data: Collected data for the 5 main variables of the model.

- OECD Data Base: Collected data for the 5 main variables of the model. (supplementary source)

- Eurostat: Collected data for the 5 main variables of the model. (supplementary source)

3.Empirical Analyses:

3.1.1 Data Description:

In this survey, a comparison will be made between highly educated people (assuming they are at least 25 years of age or older, while at the same time holding at least a bachelor's degree) who decided to leave the country and live permanently abroad. We will consider 5 different factors (based on the literature) each of them has its importance in the result, some with little impact, while some others with quite larger.

The target, i.e. the dependent variable, will be the number of people who left each country every particular year that will be studied. All variables mentioned above will be taken into consideration for their significant influence on the dependent variable, whether positive, negative, or no significant influence. After studying the literature in depth, it is expected to see the multiple factors mentioned above having a statistically significant influence on the model. It is expected population, and unemployed rate to have a positive impact.

It is expected GDP per capita, and Government spending on education (Expenses) to have a negative impact. Gini index it is not entirely clear the relationship that is expected to exist, since the regression must first be done.

At this point, it would be beneficial to be reminded of our immeasurable observations, which are included in the error of the regression. The main elements that are expected to have positive impact to Brain Drain, are dissatisfaction with the nation of origin's political leadership and administration, forced relocation because of fighting or war, globalization, and easier access to worldwide information and easier transportation.

The main elements that are expected to have negative impact to Brain Drain, are fear of the unknown or/and failure, lack of funds and visa issues.

Relationships and family dynamics are an example of things that might have opposing impacts at the same time. It can work negatively when the person's close family members are in the same nation and urge him to stay, but it can work positively when the family of the individual may already be abroad and push him to settle with them.

The main sources of the dataset for the research were mentioned in part 2.2 (Evidence Base). The reasons for using these sources are listed below:

World Bank Data: "The World Bank's premier compilation of international data on global development is called World Development Indicators (WDI). With some time-series going back more than 50 years, the WDI gives users access to almost 1,600 indicators for 217 economies, derived from officially recognized sources and encompassing national, regional, and global estimates." – Wikipedia

OECD Data: "Because it releases comparative information on a wide range of topics, the OECD is recognized as a statistical agency. The primary statistical databases of the OECD were made available to the public in July 2014 via the OECD Data Portal, an online tool that lets users make bespoke charts using official OECD statistics." – Wikipedia

Eurostat: "Microdata from Eurostat is handled with stringent confidentiality and theoretically permits the identification of the statistical unit (e.g., an individual in the labor force survey or

an organization for innovation statistics). Research institutes are given access to a variety of anonymized datasets for verified projects under strict security protocols." – Wikipedia

<u>IAB Institute</u> (Institut für Arbeitsmarkt- und Berufsforschung der Bundesagentur für Arbeit KdöR): "The Institute for Employment Research (IAB) carries out labor market research to provide knowledgeable advice to political actors at all levels. Through superbly connected national and worldwide research, economists, sociologists, and academics from other social science and methodological fields lay the groundwork for empirically sound labor market policy." – Wikipedia

3.1.2 Variables & Explanation:

GDP per Capita: "Gross Domestic Product (GDP) per capita is a measure of the economic output of a country per person. A higher GDP per capita generally indicates greater economic prosperity and may lead to fewer individuals leaving the country in search of better economic opportunities."

Unemployment rate: "The unemployment rate represents the percentage of the labor force that is unemployed and actively seeking employment. A high unemployment rate may indicate a lack of job opportunities, which could drive skilled individuals to emigrate to countries with lower unemployment rates."

Population: "Population is defined as all nationals present in, or temporarily absent from a country, and aliens permanently settled in a country. This indicator shows the number of people that usually live in an area. Total population includes the following: national armed forces stationed abroad; merchant seamen at sea; diplomatic personnel located abroad; civilian aliens' resident in the country; displaced persons resident in the country. However, it excludes the following: foreign armed forces stationed in the country; foreign diplomatic personnel located in the country; civilian aliens temporarily in the country."

Gini index: "The Gini index, also known as the Gini coefficient, is a measure of income inequality within a population. It quantifies the extent to which the distribution of income or wealth among individuals or households deviates from perfect equality, where everyone has the same income. The Gini index ranges from 0 to 1, where 0 represents perfect equality (everyone has the same income) and 1 represents perfect inequality (one person has all the income"

Expenses: "Educational expenditure refers to the current operating expenditures in education, including wages and salaries and excluding capital investments in buildings and equipment.

3.2. Descriptive Analyses:

This section of the study will feature tables, scatter plots, and graphics that will aid in drawing pertinent conclusions and information about the Brain Drain phenomenon. Subsequently, in this section will feature graphics focused on Cyprus that include a variety of economic variables and the nations that the country appears to have the closest ties to.
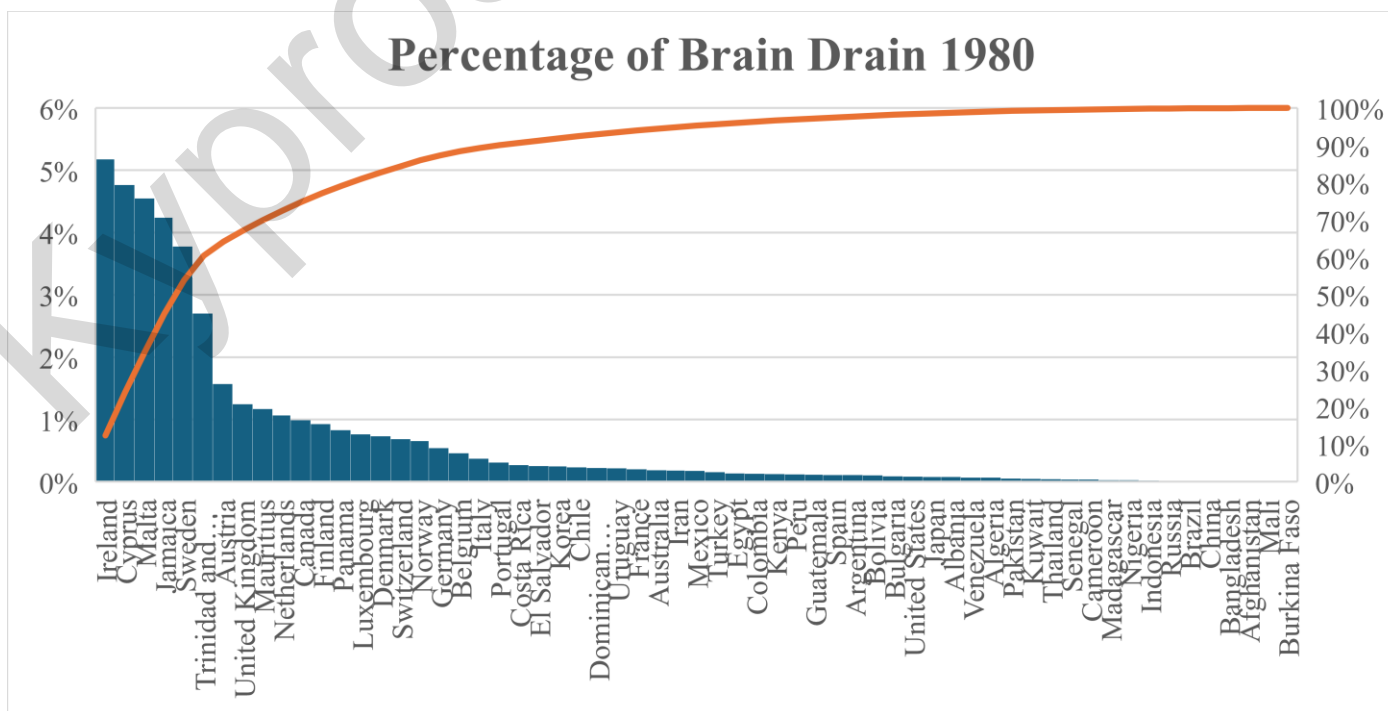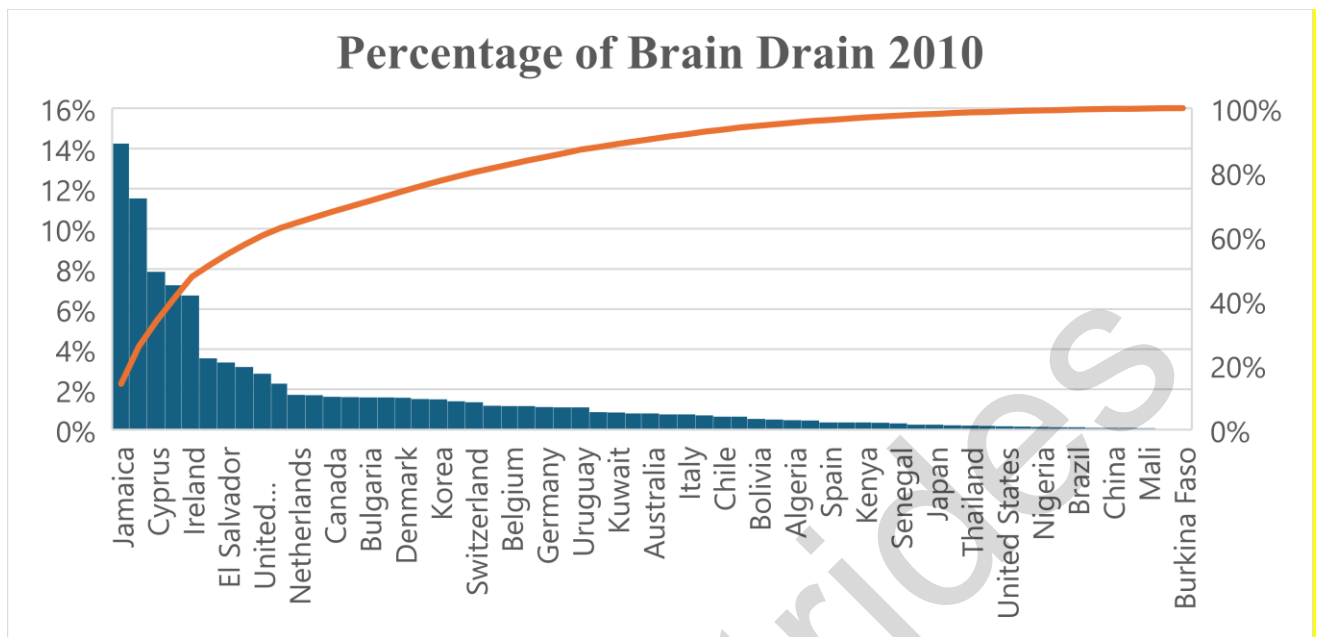
Figure 1:

Figure 2:

Percentage of Brain Drain 2010

Figures 1 & 2 present the percentage of "Brain Drain" of the 61 countries studied. The percentage is exported by dividing the total outflows of high level educated individuals by the total workforce of the country. A truly (negatively) impressive result is the fact that Cyprus is consistently among the top 5 countries with the highest output rate for the period 1980-2010.

Scatter Plot 1:
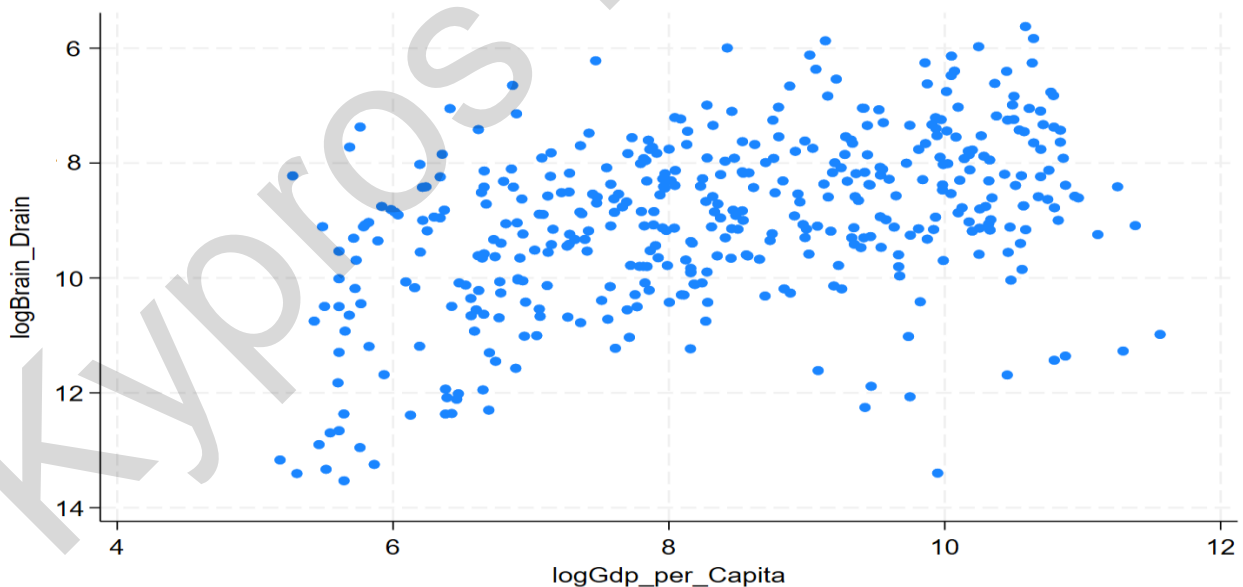
Scatter plot 1 is a diagram that shows the Brain Drain (from the country of origin) on the vertical axis, while the horizontal axis shows the GDP per Capita (country of origin). The conclusion drawn from this chart concerns the negative relationship that the two variables have, that is, the more GDP per capita increases in the country of origin, the smaller the phenomenon of Brain Drain.

Scatter Plot 2:

        Scatter plot 2 is a diagram that shows the Brain Drain (from the country of origin) on the vertical axis, while the horizontal axis shows Population (country of origin). The conclusion drawn from this chart concerns the positive relationship that the two variables have, that is, the more population increases in the country of origin, the bigger the phenomenon of Brain Drain.
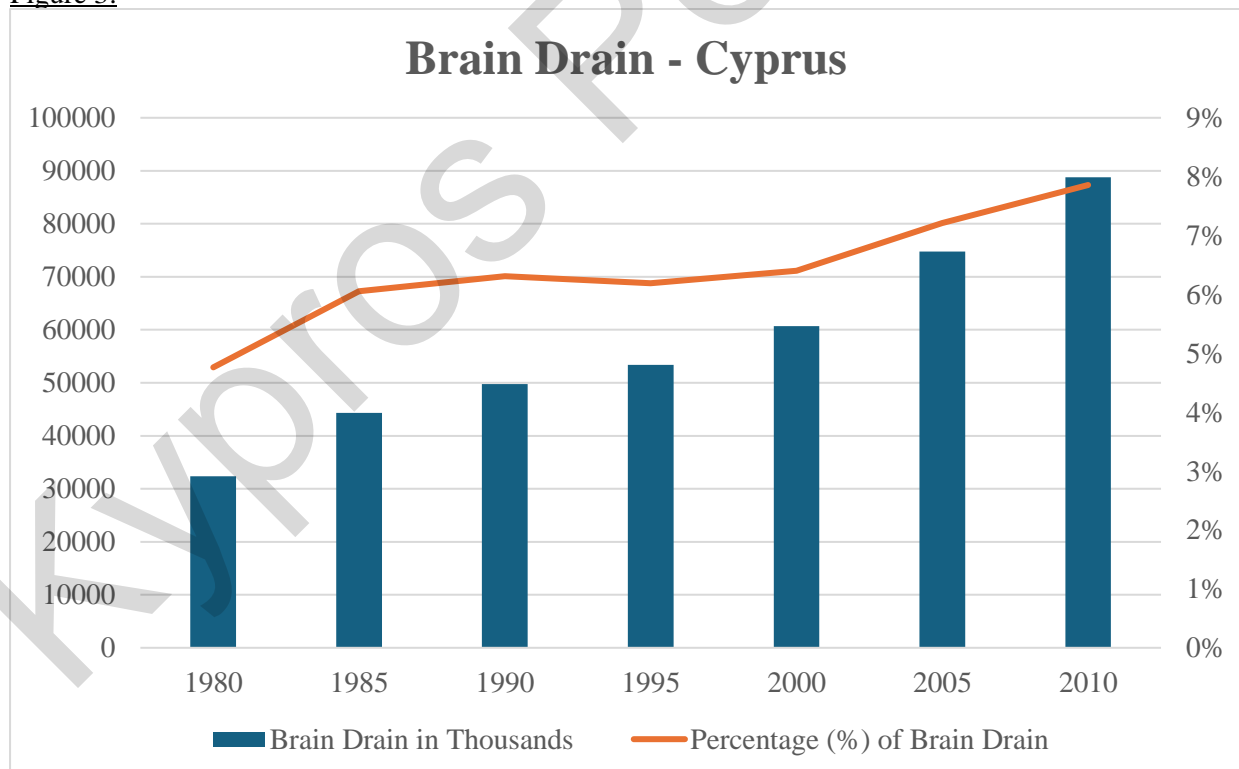
Figure 3:

Figure 3 presents both the outflows number of high level educated individuals both in percentage and total number of Cyprus from 1980 to 2010, every 5 years. The conclusion derived from this particular graphic representation is that both percentage and total number of high skilled individuals that tend to leave Cyprus, have increasing tension through the years.
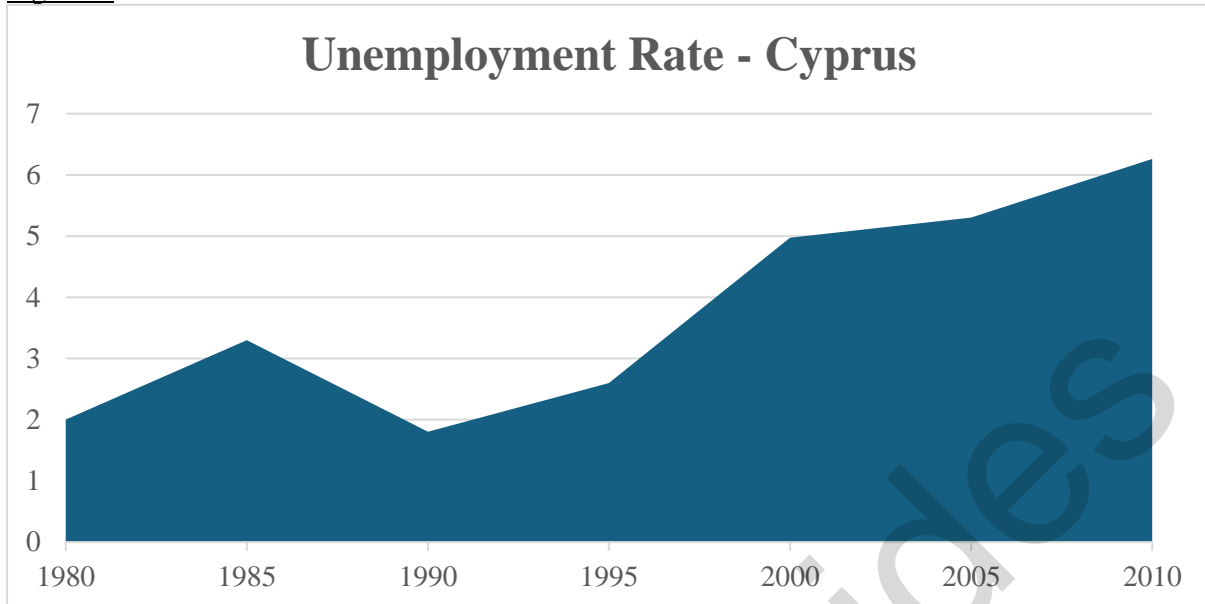
Figure 4:

Unemployment Rate - Cyprus

Figure 4 presents the unemployment rate of Cyprus from 1980 to 2010, every 5 years. The conclusion derived from this particular graphic representation is that unemployment rate in Cyprus (with a small exception between 1985-1990) has increasing tension through the years.

As a combined result with the previous figure 3, Cyprus through the years tend not only to lose the brightest brains of the labour market but increasing the unemployment rate in the economy as well.

Figure 5:

Expenses on Education per Capita (in Dollars) - Cyprus
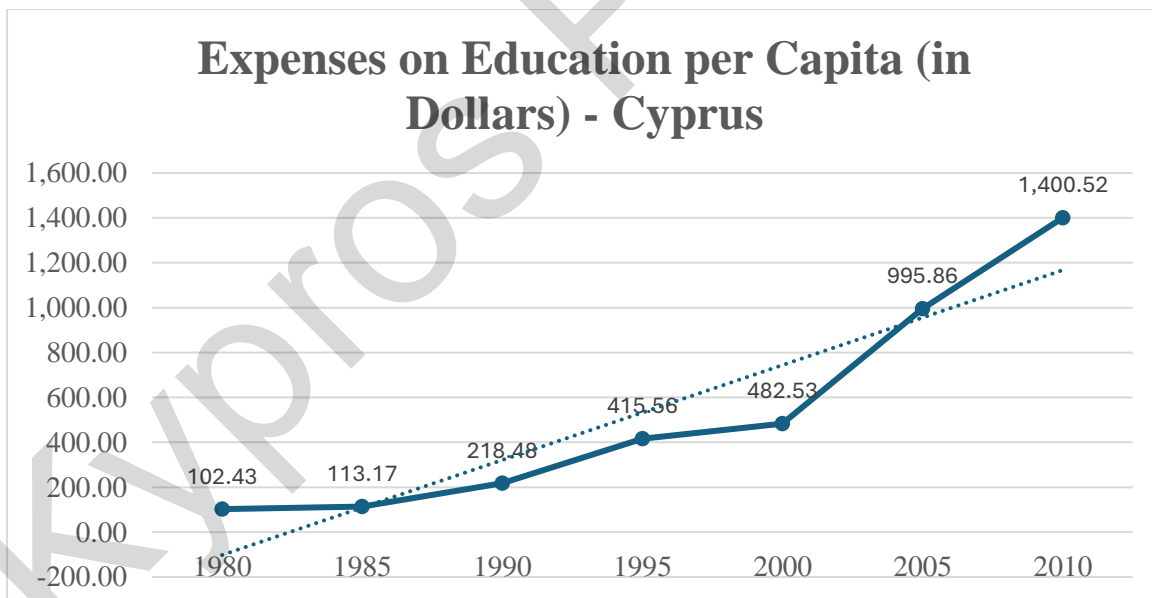
Figure 5 presents operating expenditures in education, including wages and salaries and excluding capital investments in buildings and equipment of Cyprus from 1980 to 2010, every 5 years. The conclusion derived from this particular graphic representation is that government expenses for education in Cyprus have increasing tension through the years, however Cyprus is not able to keep most of the higher educational-skilled of the Cypriot labour.
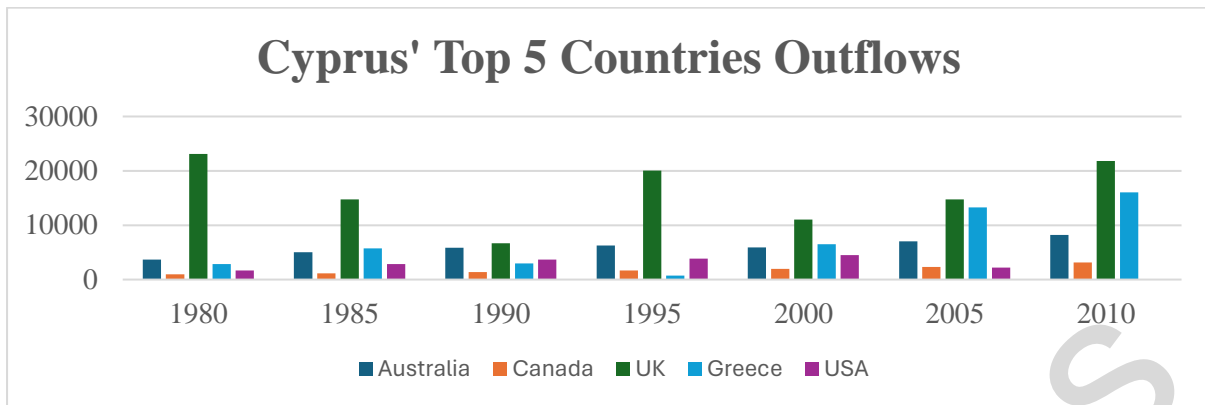
Figure 6:

Cyprus' Top 5 Countries Outflows

Figure 6 presents Cyprus' Top 5 most attractive destination for high level educated individuals from 1980 to 2010, every 5 years. The only stable ranking country is UK, which is consistent the first choice of preferences.

Figure 7:

Cyprus' Top 5 Countries Outflows - Men

Figure 7 presents Cyprus' Top 5 most attractive destination (mentioned above – Figure 6) for high level educated men from 1980 to 2010, every 5 years.

Figure 8:

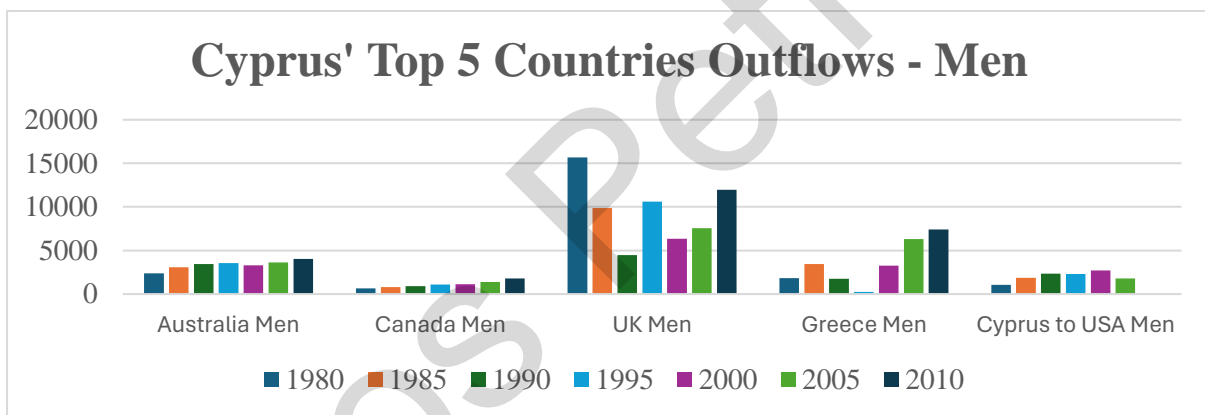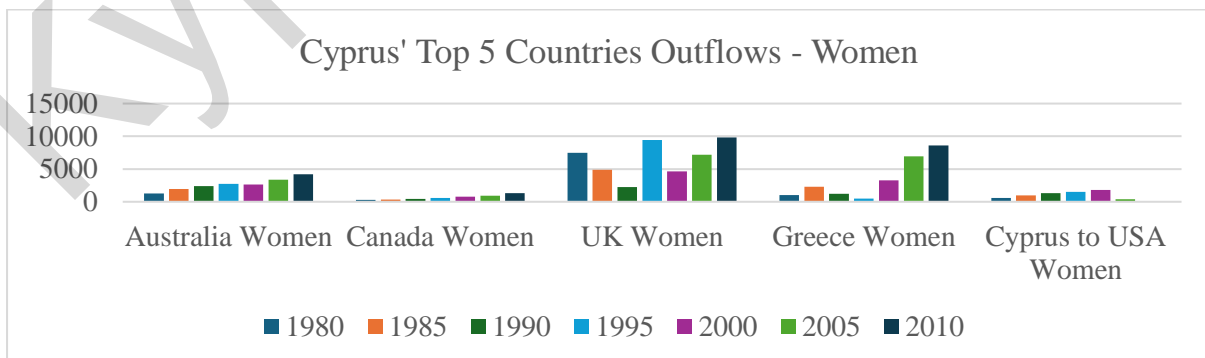Cyprus' Top 5 Countries Outflows - Women

Figure 8 presents Cyprus' Top 5 most attractive destination (mentioned above - Figure 6) for high level educated women from 1980 to 2010, every 5 years.

3.3. Regression Analyses:

Econometric Model:

The present researh will be based on OLS method, and the regression model in the form $Y = b_0 + \beta_1 X_1 + \beta_2 D + ... + \beta_p X_p + u$, where Y will be the dependent variable (Brain Drain: the number of individuals who left a country), X1, X2 etc. all independent variables, and U errors. There are not any dummy variables in this model.

The dependent variable Brain Drain takes only integer positive values. In detail the regression model that emerged is as follows:

Logbrain_drain = b0 + β1loggdp_per_capita + β2unemployment_rate + β3logpopulation + β4gini_index + β5expenses + u

Table 1:

TABLE OF VARIABLES MODEL - 1	
Variables	**Explanation of Variables**
LogBrainDrain (Dependent Variable)	Logarithm of the number of individuals left a country
LogGDP_per_Capita	Logarithm of the Gross Domestic Product (GDP) - country of origin
Unemployment Rate	Percentage of labour fource that is unemployed and actively seeking employment - country of origin
LogPopulation	Logarithm of the total amount of all nationals in, or temporarily absent from a country - country of origin
Gini_Index	Measure of income inequality within a population. The Gini index ranges from 0 to 1, where 0 represents perfect equality (everyone has the same income) and 1 represents perfect inequality (one person has all the income)
Expenses	Education expenditure refers to the current operating expenditures in education, including wages and salaries and excluding capital investments in buildings and equipment

Table 1 presents the dependent variable, the independent variables, and their explanation, where they will be considered and will form the basis for creating the model.

The course followed to export this model will be analyzed immediately below.

Assessing the independent variables, it was observed that variables such as Brain Drain, Population and GDP per Capita had values that would not be easy to process in the form they were in, and so it was decided to make them in a logarithmic form, where their values are more convenient to use.

Fixed/Random Effects:

The next step was to decide whether to use fixed effects or random effects as our samples consist of panels. The test's zero assumption—that is, that the model's effects are random—was rejected, leading to the usage of fixed effects, which were determined using the Hausman test. The phrase "constant effects" refers to situations in which the Brain Drain phenomena is seen and ascribed to unquantifiable causes. As was previously said, a few of them are the Dissatisfaction with the nation of origin's political leadership and administration, Forced relocation because of fighting or war, Immigration because of family connections, globalization, access to worldwide information through the years, easier transportation through the years, fear of the unknown or/and failure, lack of funds, visa, etc.

FE checked at entity and time level with clustered robust standard errors to control unobservable heterogeneity at the entity level. (e.g. individual, firm, country) and the level (e.g., year, month). This helps to account for any time-invariant characteristics of entities at a given time.

Heteroskedasticity:

A stage that is equally crucial is heteroskedasticity analysis. There is variability when it comes to panel data, according to the research. In order to prevent mistakes, the White Test was used to conduct a test in which heterogeneity was found when the zero hypothesis, which claimed homogeneity, was rejected. Thus, the optimal choice for the model is to use robust standard errors (Robust SE) in place of the typical standard errors. I obtain better results with robust SE, but I do not eliminate heteroskedasticity.

Expected Correlations:

Table 2:

TABLE OF EXPECTED CORRELATION - 3	
Variables	**Expected Correlation**
LogGDP_per_Capita	Negative (-)
Unemployment Rate	Positive (+)
LogPopulation	Positive (+)
Gini_Index	Not Clear (?)
Expenses	Negative (-)

Table 2 presents the expected correlation of the independent variables on Brain Drain.

Table 3:

TABLE OF STATISTICS - 4					
Variable	**Obs**	**Mean**	**Std. dev.**	**Min**	**Max**
Year	427	1995	10.012	1980	2010
Brain Drain	427	143765	218945.4	645	1755125
Gdp per Capita	427	11648	15688.43	177.760	104965.3
Unemployment Rate	427	7.453	5.143	0.2	35.51
Population	427	5.68E+07	1.56E+08	316645	1.34E+09
Gini Index	427	38.263	10.184	9	61.6
Expenses	427	2654.905	17282.03	1.596	217987
Country	427	31	17.627	1	61
logBrain_Drain	427	11.011	1.478	6.469	14.378
logGdp per Capita	427	8.360	1.569	5.180	11.561
logPopulaton	427	16.528	1.641	12.666	21.014

Table 3 presents the basic information about the variables that are included in the model.

4.Results of Empirical Analysis:

Table 4:

TABLE OF REGRESSION - 5			
Variable	**Coefficient**	**Robust std. err**	**P > |t|**
Gdp per Capita (Log)	-0.160	0.922	0.094*
Unemployment Rate	0.0078	0.011	0.462
Population (Log)	0.873	0.464	0.065*
Gini Index	-0.0019	0.008	0.819
Expenses per Capita	-3.95E-06	1.95E-06	0.047**
Method	OLS - Fixed Effects, Robust		
Entity Level	YES		
R - Squared	Within: 0.7621	Between: 0.1524	Overall: 0.2290
Number of Observations	427		

Table 4 presents the correlation of the independent variables on Brain Drain.

INTERPRETATION OF RESULTS:

GDP:

By holding anything else at a constant level, for each 1% increase in GDP per Capita, Brain Drain decreases by 0.16% on average. This relationship is statistically significant at the 10% level.

Unemployment Rate:

By holding anything else at a constant level, for every 1 unit increase in Population, Brain Drain increases by 0.78% on average. This relationship is not statistically significant at any level.

Population:
By holding anything else at a constant level, for each 1% increase in Gini Index, Brain Drain increases by 0.87% on average. This relationship is statistically significant at the 10% level.

Gini Index:
By holding anything else at a constant level, for every 1 unit increase in Population, Brain Drain decreases by 0.19% on average. This relationship is not statistically significant at any level.

Expenses:
By holding anything else at a constant level, for every 1 dollar increase in Expenses, Brain Drain decreases by 0.000395% on average. This relationship is statistically significant at the 5% level.

R-Squared:
The independent variables used in this model, explain 22.90% of the Brain Drain variation.

5. Conclusion:

"Brain mobility," or the movement of researchers and postsecondary students, has gained prominence in recent years, especially in Europe where it has become an important feature of higher education strategies in several countries.

Skills and knowledge are additional types of capital. People's capital is derived from their knowledge and skills. The world in recent decades has begun to perceive more and more the importance of a highly educated individual, as an equally important weapon in the quiver of an organization, an enterprise, and even the whole of the labour force of a country with great prospects for the future. Therefore, countries around the world are initially trying to keep their own highly educated individuals, who have been trained in the country (mostly with government expenses), while at the same time trying to be an attractive destination for highly educated people from all around the globe, which will help in the faster and more effective development of the country.

In contrast to this viewpoint, there has long existed a negative perception of international mobility, or more precisely, of certain of its (claimed) effects, which are linked to worries about the "brain drain." Massive "brain drain" has the potential to destabilize a country's higher education and scientific systems, as many rising nations seem to be experiencing. The term "brain drain" has been used frequently to describe the migration patterns among developed nations.

"Brain Gain" and "Brain Drain" are two different ideas (with positive and negative meaning respectively), that fall under the umbrella term "Brain Mobility." These phenomena may have advantages as well as disadvantages. In the negative, we observe that the loss of heavily invested money causes losses to the economy and human capital of the country of origin, as well as to society's potential for advancement and at the same time sharpens the gap between developed and developing countries to widen. Losses of a significant amount of public cash intended to help immigrants build their human capital since those money will be utilized by another country.

On the positive side for the nations of origin, it is highlighted the fact that financial transfers, or the money migrants bring back to their home country from their earnings in the countries of destination, have a proven beneficial effect.

Regarding the host countries, the immigration wave widens the gap between rich and poor countries since it increases the quantity of human capital that is accessible, creating positive technological externalities in contrast to the host economies (destination nations). As a result, the destination nations' growth rates quicken and their R&D output accelerates and improves in quality and speed, which will aid a state's economy, standard of life, and other areas of overall development in several ways.

In contemporary Cyprus, where labor mobility inside the EU is permitted, an increasing number of scientists are relocating overseas while also refusing to return home.

The greatest opportunities for career advancement, the potential to find employment that matches the individual's qualifications, competitive pay, the drive to increase knowledge of the field in which one works, Cyprus's lack of dignity, and the extent of corruption are the main reasons for emigrating.

It was observed that although the Cypriot government is spending more on scientists' education in an attempt to retain them in the country, the results are not being as good as they could be. Our highly educated individuals seem to be leaving in greater numbers, with the most sought-after destinations being the United States, the United Kingdom, Australia, Canada, and Greece.

The results of the empirical research show that the GDP per Capita & Expenses on education per Capita have negative impact on Brain Drain. On the other hand, the total amount of population of a country affects Brain Drain in a positive way. The Unemployment Rate did not show a statistically significant effect, however, moves as one would expect, i.e. the greater the Unemployment rate, the greater the brain drain. Gini Index has neither statistically significant effect nor clear effect on Brain Drain. The reasons as it has been analyzed above, is because Gini Index can cause two opposite results at the same time. For example, the greater the inequality in a country, the more likely it is for its scientists to abandon it, but the same time, the highest proportion in the highly paid workforce will be held by high educated individuals since they are more likely to earn higher wages.

In conclusion, it's clear that the occurrence of scientists leaking knowledge overseas suggests that certain nations are unable to effectively utilize their scientific capacity, which limits such nations' opportunities for progress and development. Unfortunately, Cyprus is country among them, and there is a lot of to consider from the authorities that take nation's decisions so that Cyprus does not fall further and widen the gap between it and the developed countries of the world.

Brain Drain is a powerful phenomenon which seems to be expanding year after year, to a point where it has begun to reach alarming levels. It is a phenomenon that needs to be studied and monitored, which, unfortunately, due to its multidimensional form and the many unmeasurable and unevaluable factors that cause it, is difficult to study and decrypt accurately. We hope that in the near future with the help of technology, more studies will come out with focus on Brain Drain that will give better interpretations as well as solutions for balancing the phenomenon.

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7.Appendix:

Table 5:

TABLE OF COUNTRIES - 2			
Countries	Countries	Countries	Countries
Afghanistan	Colombia	Jamaica	Panama
Albania	Costa Rica	Japan	Peru
Algeria	Cyprus	Kenya	Portugal
Argentina	Denmark	Korea	Russia
Australia	Dominican Republic	Kuwait	Senegal
Austria	Egypt	Luxembourg	Spain
Bangladesh	El Salvador	Madagascar	Sweden
Belgium	Finland	Mali	Switzerland
Bolivia	France	Malta	Thailand
Brazil	Germany	Mauritius	Trinidad and Tobago
Bulgaria	Guatemala	Mexico	Turkey
Burkina Faso	Indonesia	Netherlands	United Kingdom
Cameroon	Iran	Nigeria	United States
Canada	Ireland	Norway	Uruguay
Chile	Italy	Pakistan	Venezuela
China			

Table 5 presents all the countries, that will be considered and will form the basis for creating the data set.