

RESEARCH ARTICLE

# Exploring the Determinants of Brain Drain: Evidence From a Cross-Country Panel From 2013 to 2021

Martha Joy J. Abing,\* Charlyn M. Capulong, Maria Rizalia Y. Teves, Resa Mae C. Laygan, Diane Mae P. Sangga, Junrie C. Vendra, Adama D. Villarico, and Honey Mae E. Beruela  
MSU- Iligan Institute of Technology, Iligan City, Philippines  
\*marthajoy.abing@g.msuiit.edu.ph

This study investigates the factors influencing brain drain, the flight of human capital from their home country. The study examines the drivers of brain drain by looking into the effects of the following: global peace index, CO2 emissions per capita, real minimum wage, and happiness index and its individual indicators. Using pooled OLS on an unbalanced panel, the results reveal a statistically significant yet negative effect of the happiness index and the real minimum wage on brain drain. This suggests that happy nations attract skilled professionals and emphasizes reduced skilled emigration in high-income countries. Results highlight the impact of the global peace index, revealing that decreased peace levels in the country of origin increase brain drain. Integrating each of the component indicators of the happiness index, the results validate the significance of the happiness index, global peace index, and real minimum wage. Among the component indicators of the happiness index, healthy life expectancy, absence of corruption, social support, and real minimum wage exhibit negative and statistically significant effects on brain drain. This highlights that understanding the importance of these factors is crucial for policymakers in shaping policies to mitigate human capital flight and address the challenges posed by brain drain.

*Keywords:* brain drain, happiness index, real minimum wage, global peace index

*JEL Classification:* C33, F22, H56

The economic development of a nation is profoundly impacted by its human capital. Human capital represents a valuable asset of a country, encompassing the collective knowledge, skills, and talents of its people that contribute to an increase in innovation, productivity, social well-being, equality, and to the overall progress and growth of a country. However, a growing challenge faced by many countries, particularly those in the developing world, is the increasing outflow of skilled individuals seeking better opportunities abroad.

The exodus of highly educated and skilled individuals results in the phenomenon commonly referred to as brain

drain. According to the Fund for Peace (2024), brain drain encompasses both the voluntary emigration of middle-class individuals—such as entrepreneurs or skilled professionals like physicians—who leave their home country due to economic deterioration, and the forced displacement of professionals and intellectuals fleeing political instability or repression. In either case, the migration of a country's most productive and skilled labor force can have serious economic consequences, including reduced innovation capacity, weakened service sectors such as healthcare and education, and slower long-term economic development.

Since the 1960s, brain drain has increasingly become a global concern. The United Nations Conference on Trade and Development (2012) highlighted that the least developed countries (LDCs) experience the highest brain drain rate at 18.4%, significantly higher than the 10% observed in other developing nations. Remarkably, six of the 48 LDCs have more highly skilled nationals living abroad than within their own borders. Similarly, countries such as Mexico and those in Central America report high emigration rates among individuals with tertiary education. According to the Assembly of European Regions (AER, 2020), several European countries—including Romania, Poland, Italy, and Portugal—continue to experience brain drain, despite being classified as high-income economies. Furthermore, smaller and economically vulnerable nations in Africa, the Caribbean, and Central America have seen up to 30% of their highly educated populations leave. Additional evidence points to substantial brain drain from countries such as Iran, Korea, the Philippines, and the Taiwan Province of China.

These global trends highlight the urgency for policymakers to address brain drain, particularly in developing and transitional economies. In critical sectors like healthcare and education, the loss of skilled professionals can lead to severe shortages, ultimately compromising service delivery and limiting access to essential services for the population. The persistent outflow of talent not only weakens institutional capacity but also hampers a country's ability to achieve inclusive and sustainable development.

Given the growing severity of this issue, it is essential to examine whether brain drain is influenced by a combination of economic, environmental, political, and social factors. These include variables such as GDP per capita, minimum wage levels, carbon dioxide (CO<sub>2</sub>) emissions per capita, life expectancy, absence of corruption, generosity, freedom, social support, and peace and order conditions. This study seeks to fill a research gap by empirically analyzing how these indicators affect the emigration of skilled individuals.

To provide a deeper understanding of the complex dynamics behind brain drain, this research is guided by Everett Lee's (1966) push-pull theory of migration and Abraham Maslow's (1943) hierarchy of needs. These frameworks help explain the multifaceted motivations behind individuals' decisions to emigrate, including

both external structural conditions and internal human needs. Specifically, this study aims to: (a) identify the key factors contributing to brain drain, with emphasis on the effect of the happiness index, global peace index, real minimum wage, and CO<sub>2</sub> emissions per capita; and (b) evaluate how the component indicators of the happiness index—namely GDP per capita, life expectancy, absence of corruption, generosity, freedom, and social support—explain emigration of skilled labor.

The findings of this study are intended to support effective talent management and contribute to broader discussions in the fields of migration, economics, and social policy. This paper is structured as follows: Section 1 provides the background and rationale for the study. Section 2 presents a review of the relevant literature. Section 3 outlines the data sources and research methodology. Section 4 discusses the empirical results, and Section 5 concludes with key policy implications and recommendations.

## Literature Review

Previous studies have primarily focused on the consequences of skilled migration rather than the underlying reasons why professionals choose to leave their home countries. Boffy-Ramirez (2013) found that higher expected income, particularly through increased minimum wages, attracts migrants, especially those with lower education levels, to destination countries. Velciu (2016) emphasized that when a young, college-educated individual emigrates, their departure represents not only a loss of public investment in education but also the forfeiture of their potential future income that could have contributed to national development. During the COVID-19 pandemic, Nigeria saw a sharp increase in healthcare worker emigration due to poor working conditions, low pay, and insecurity, while developed countries offered higher salaries and safer environments (Lawal et al., 2022).

In 2014, using the gathered information from the census and register on the composition of immigration in all OECD nations, the Statistical, Economic and Social Research and Training Center for Islamic Countries (SESRIC, 2014) analyzed that the income level formed a brain drain and skill gap ratio is not affected by population size but rather by income level. Nevertheless, the expected returns to higher

education abroad, which depend on differences in wages, are significantly more attractive than those within most African countries, where local wage scales are comparatively low. Because of the positive returns, most emigrants who finished their higher education abroad do not return home (Adeyemi et al., 2018). Additionally, Nwude (2013) stated in his study that highly qualified workers and professionals may migrate to a more developed country in search of greener pastures, specifically when minimum salaries are insufficient to meet their needs. Poor pay for employees causes them to move around both geographically and occupationally (geographic mobility). In such circumstances, workers frequently engage in labor mobility to seek greater opportunities.

On the other hand, environmental degradation is also one of the push factors of skilled individuals to migrate. Carbon dioxide emissions are one of the contributing factors to air pollution. The findings of the study of Nguyen (2022) have shown that an increase in industrialization and populations worsen the air quality, which resulted in air pollution. This poor air quality influences individuals to move to a healthier environment, especially those individuals whose family members have suffered from diseases caused by air pollution. This observation is consistent with the study by Xue (2021), which found that people seek jobs in less polluted areas when pollutants are evident in their current areas. The study had shown that there is a significant decline in skilled employees and executives to those firms located in polluted areas, as this poses greater health concerns. This results in a decrease in the firm's productivity. Furthermore, a study conducted by Zhou (2021) indicated that air pollution has a positive relationship to the migration decision of individuals. The findings indicated that the possibility of migration increases as perceived pollution in the area increases. In addition, the study by Mott et al. (2021) indicated that developed nations, in addition to certain affluent oil-producing developing countries, exhibit the highest per capita emissions, with nearly all surpassing the global average. Although developed countries have displayed a decline in per capita emissions, their levels still significantly exceed those of developing countries, highlighting a substantial disparity. Furthermore, undoubtedly, industrialization is necessary for economic growth. However, it also poses detrimental effects on both human well-being and the environment. It has been shown that rapid industrial development

negatively impacts the entire bio-network influencing elements within natural systems such as air, water, soil, and the surrounding ecosystems (Ahmed et al., 2022; Magsi, 2014). According to the studies by Naz et al. (2019), Pata (2018), and Apergis and Payne (2015), a long-run relationship between industrialization and carbon dioxide emissions is positive and statistically significant, indicating that industrialization contributes to CO<sub>2</sub> emissions. Thus, the more a country is industrialized, the higher its carbon dioxide emissions.

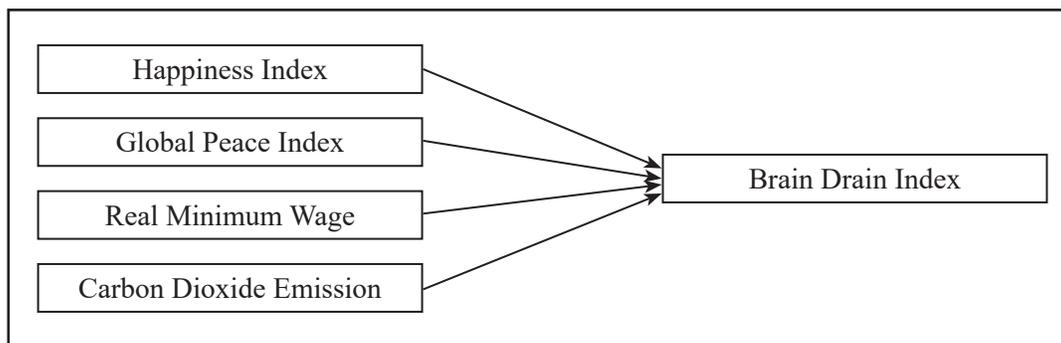
The research shows that industrialization creates economic opportunities that attract professionals and individuals. According to Smith (2018), the development of industries and the expansion of job opportunities in industrialized countries lead to an increased migration and higher living standards. The finding suggests a positive relationship between industrialization and migration, as economic factors significantly influence migration patterns. In addition, the study of Johnson (2020) indicated that industrialization attracts people looking for work and better living conditions. The research study by Chen (2017) highlighted the significance of a thorough understanding of industrialization's effects on migration and focuses attention on its global implications. The growth of manufacturing industries in developed countries would lead to an increase in labor demand, which is met by international migration from developing countries.

A few studies also examine the relationship between brain drain and happiness. According to the study by Polgreen and Simpson (2010), emigration rates and happiness are inversely correlated. This means that with higher emigration rates in relatively poor countries and lower emigration rates in generally happy ones. The U-shaped link also applies to migrant arrivals in the United States. For relatively unhappy countries, net migration is linked. Additionally, findings using these data indicate a U-shaped association between happiness and emigration rates: emigration rates are relatively high in very miserable countries. However, in happy nations, emigration rates decline. Similarly, the empirical study of Ostrachshenko and Popova (2014) found that socioeconomic status and microeconomic conditions contribute to an individual's life satisfactions that affect the migration decision. The results showed that dissatisfied individuals are more likely to migrate. On the contrary, the findings of Ivlevs (2014) showed that a higher subjective well-

being contributes to an increase in an individual's health, productivity, creativity, and sociability. The finding indicated that an increase in an individual's life satisfaction has increased the probability of the intentions and willingness to migrate. This raises some concerns about the possibility of "happiness drain" and leads to the question: why make people happier if they are more likely to move elsewhere?

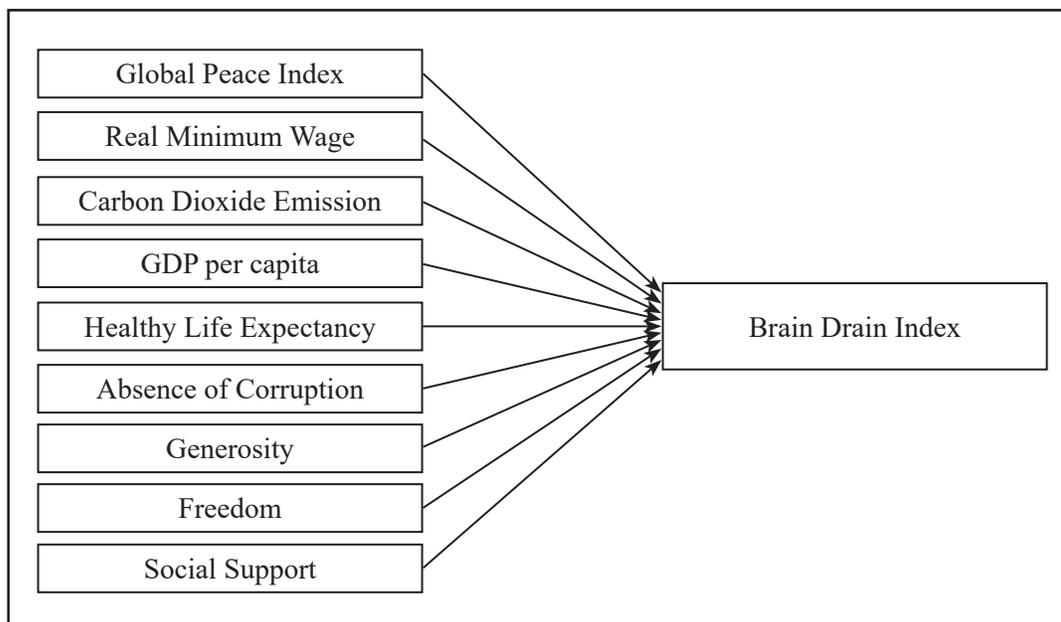
Although previous studies have explored brain drain in specific contexts, there is a need to examine the overall patterns and factors contributing to the human capital flight, which would significantly result in brain drain during the time frame, 2013 to 2021. The existing research took into account the impact of remittances rather than the effect of brain drain resulting in human

capital flight. The existing literature also lacks an examination of the interrelationships between brain drain and key independent variables such as the real minimum wage, carbon dioxide emission per capita, global peace index, and happiness index and its factors such as the GDP per capita, generosity, life expectancy, social support, freedom, and absence of corruption. Although these variables have been separately studied in various contexts, their combined influence on brain drain remains understudied. Therefore, this research intends to understand the potential correlations and effects of these variables on brain drain as well as provide valuable insights into the drivers and consequences of brain drain worldwide.



**Figure 1**

Schematic Diagram of the Effects of Happiness Index, Global Peace Index, Real Minimum Wage, and CO2 Emission Per Capita on Brain Drain.



**Figure 2**

Schematic Diagram of the Effects of Each of the 6 Component Indicators of Happiness Index, Global Peace Index, Real Minimum Wage, and CO2 Emission Per Capita on Brain Drain

## Conceptual Framework

This study assessed the impact of several macro-level variables on brain drain across 121 countries from 2013 to 2021. The variables used to explain brain drain include the happiness index (measured by GDP per capita, healthy life expectancy, absence of corruption, generosity, freedom, and social support), the global peace index, carbon dioxide emissions per capita, and real minimum wage. These variables represent broader societal, environmental, and economic challenges that may influence migration decisions. The study's conceptual framework is presented in two schematic diagrams (Figures 1 and 2) that illustrate the hypothesized effects of these variables on brain drain.

Previous empirical studies provide context for these relationships. Polgreen and Simpson (2010) found a negative relationship between emigration and happiness, whereas Seifi et al. (2020) showed that terrorism—one of the global peace index components—positively influences capital flight in the Middle East. Boffy-Ramirez (2013) suggested that higher minimum wages attract migrants, particularly lower-educated workers. Xu and Sylwester (2016) found a positive link between air pollution and highly educated emigration, identifying environmental degradation as a driver of brain drain. Additionally, GDP per capita and healthy life expectancy are found to negatively correlate with migration, indicating that better living standards can reduce brain drain (Benček & Schneiderheinze, 2024; Popogbe & Adeosum, 2020).

Other happiness factors also show significant associations. A lower level of corruption is linked to increased emigration, as shown by Imran Arif (2022), suggesting that skilled workers prefer countries with cleaner governance. Razin, Sadka, and Suwankiri (2016) found that generous welfare states tend to retain skilled migrants, whereas Aarhus, J. H., & Jakobsen (2019) noted that greater economic freedom reduces emigration among highly skilled individuals. The concept of freedom—closely tied to economic and personal autonomy—can thus influence well-being and migration choices. Furthermore, Güngör and Tansel (2014) and Lovo (2014) emphasized the importance of social support and life satisfaction in reducing emigration intentions, reinforcing the idea that stronger societal cohesion can help mitigate brain drain.

## Research Method

### *Scope and Data Utilization*

This study investigates the impact of various societal issues—including social welfare, global peace, industrialization, economic, and political factors—on individuals' decisions to migrate abroad, resulting in brain drain. The analysis covers 121 countries worldwide from 2013 to 2021. Countries were selected based on data availability and reliability. The resulting unbalanced panel includes 34 countries from Asia, 38 from Africa, 10 from North America, five from South America, 32 from Europe, and two from Australia. The study focuses on macro-level variables such as real minimum wage, carbon dioxide emissions per capita, global peace index, and components of the happiness index (GDP per capita, generosity, life expectancy, social support, freedom, and absence of corruption), while acknowledging that certain cultural or historical factors are not captured.

To examine the effects of these factors on brain drain, the study employed panel data regression analysis, combining cross-sectional and time-series data. The dependent variable, brain drain, is measured using the brain drain index, whereas the independent variables are drawn from credible sources such as Our World in Data, the World Happiness Report, the International Labour Organization (ILO), Fund for Peace, and Country Economy. All data used are continuous in nature, allowing for a nuanced statistical examination of how broad societal conditions influence the global phenomenon of human capital flight.

The brain drain index is measured using the Human Flight and Brain Drain Indicator from the Fund for Peace. This indicator captures the economic impact of human displacement—whether for political or economic reasons—and its consequences on a country's development. It reflects voluntary emigration, especially among the economically productive segments of the population, such as entrepreneurs and skilled professionals. The index ranges from one to 10, with higher scores indicating greater brain drain, which implies a significant outflow of skilled professionals (Fund for Peace, 2024). The global peace index, developed by the Institute for Economics and Peace (2023), measures the level

of peacefulness in countries, with scores closer to “1” indicating more peaceful conditions and scores approaching “5” indicating less peace. The real minimum wage reflects the attractiveness of a country’s labor market. It is standardized in U.S. dollars using exchange rates or purchasing power parity for private consumption expenditures, with 2017 as the base year (ILO, 2023). Carbon dioxide emissions per capita are used as a proxy for industrialization, calculated by dividing a country’s total annual emissions by its population (Ritchie, Roser, & Rosado, 2023). Lastly, the happiness index measures citizens’ perceived well-being, with respondents rating their lives from 0 (worst possible) to 10 (best possible; (Helliwell, Layard, Sachs, De Neve, Aknin, & Wang, 2023, World Happiness Report 2023)).

### ***Method of Estimation***

This study employed a pooled ordinary least squares (pooled OLS) regression to analyze the relationship between key macro-level variables and brain drain across 121 countries from 2013 to 2021. A dual-model framework was applied. Model 1 investigates the impact of the primary independent variables—global peace index, real minimum wage, carbon dioxide emissions per capita, and the overall happiness index—on brain drain. Model 2 extends the analysis by decomposing the happiness index into its six component indicators, namely: GDP per capita, healthy life expectancy, absence of corruption, generosity, freedom, and social support, while retaining the other explanatory variables. This extended model provides a more detailed examination of the specific drivers behind skilled labor migration. All happiness-related variables used in Model 2 are expressed as proportionate scores of the overall happiness index.

In view of the unbalanced data structure and the relatively short time dimension (T much less than N), this study employed pooled OLS as the main estimation method for both models. Although pooled OLS does not control for individual heterogeneity or potential endogeneity, it remains an appropriate method when the primary focus is on estimation

and inference, provided that key assumptions are tested and addressed through diagnostic adjustments (Baltagi, 2008). Diagnostic tests revealed evidence of heteroskedasticity, first-order serial correlation, and cross-sectional dependence in both Model 1 and Model 2. To address these issues, cluster-robust standard errors at the country level were applied in the final models. The cluster-robust standard errors at the country level correct for heteroskedasticity and autocorrelation within units (Cameron & Miller, 2015). Additionally, year fixed effects were included to account for time-specific shocks that may affect all cross-sectional units simultaneously. Although the issue of cross-sectional dependence could not be entirely resolved due to data constraints, the adjustments implemented were considered appropriate and reasonable given the dataset’s limitations.

It must be noted that before selecting pooled OLS as the final estimation method in both models, alternative panel estimators were initially considered to address unobserved heterogeneity and potential endogeneity. The fixed effects (FE) model was initially estimated, with the Hausman test favoring it over random effects, indicating correlation between regressors and unit-specific effects. However, the overall FE model was statistically insignificant, possibly due to limited within-unit variation caused by the short time dimension and unbalanced panel structure, which are known to reduce its efficiency (Judson & Owen, 1999). The system generalized method of moments (system GMM) estimator, suitable for panels with small T and large N (Blundell & Bond, 1998), was also explored to address possible endogeneity problems of the models. However, diagnostic tests revealed significant second-order autocorrelation (AR(2)), suggesting model misspecification and a violation of one of the key assumptions of GMM. Moreover, GMM estimates can be particularly sensitive to unbalanced panels, where missing observations may introduce bias and inefficiency (Albarran et al., 2019). Given these limitations, the GMM results were excluded from the final analysis.

### ***Empirical Model***

The first model of this study takes the following statistical form:

$$BRN_{it} = \beta_0 + \beta_1 HI_{it} + \beta_2 GPI_{it} + \beta_3 \ln RMW_{it} + \beta_4 CO2_{it} + Z_t + \varepsilon_{it}, \quad (1)$$

where

- BRN** = refers to the brain drain index  
**i** = refers to the Countries  
**t** = refers to the time covered from 2013-2021  
 $\beta_1, \beta_2, \beta_3, \beta_4, \beta_5$  = refers to the slope coefficient of HI, TEMP, RMW  
**HI** = refers to the happiness index of the countries *i* for the years 2013-2021  
**GPI** = refers to the global peace index of the countries *i* for the years 2013-2021  
**RMW** = refers to the real minimum wage of the countries *i* for the years 2013-2021, in log form  
**CO2** = refers to the Carbon Dioxide Emissions per capita of the countries *i* for the years 2013-2021  
**Z** = refers to year fixed effects which are included to control for time-specific shocks common across countries  
**ε** = refers to the error term

The second model integrates the six component indicators of the happiness index, encompassing the initial model, which potentially demonstrates a contributing role in the phenomenon of brain drain. The second model of this study takes the following statistical form:

$$BRN_{it} = \delta_0 + \delta_1 GDP_{it} + \delta_2 LE_{it} + \delta_3 Crrptn_{it} + \delta_4 Gnrsty_{it} + \delta_5 Frdm_{it} + \delta_6 SS_{it} + \delta_7 GPI_{it} + \delta_8 \ln RMW_{it} + \delta_9 CO2_{it} + Z_t + \varepsilon_{it} \quad (2)$$

where

- BRN** = refers to the brain drain index  
**i** = refers to the countries  
**t** = refers to the time covered from 2013-2021  
 $\delta_1, \delta_2, \delta_3, \delta_4, \delta_5$  = refers to the slope coefficient of GDP, LE, AC, G, F, SS, GPI, RMW, CO2  
**GDP** = refers to the happiness index explained by Gross Domestic Product of the countries *i* for the years 2013-2021  
**LE** = refers to the happiness index explained by healthy life expectancy of the countries *i* for the years 2013-2021  
**Crrptn** = refers to the happiness index explained by the absence of corruption of the countries *i* for the years 2013-2021  
**Gnrsty** = refers to the happiness index explained by generosity of the countries *i* for the years 2013-2021  
**Frdm** = refers to the happiness index explained by freedom to make life choices of the countries *i* for the years 2013-2021  
**SS** = refers to the happiness index explained by social support of the countries *i* for the years 2013-2021  
**GPI** = refers to the global peace index of the countries *i* for the years 2013-2021  
**RMW** = refers to the real minimum wage of the countries *i* for the years 2013-2021, in log form  
**CO2** = refers to the carbon dioxide emissions per capita of the countries *i* for the years 2013-2021  
**Z** = refers to year fixed effects which are included to control for time-specific shocks common across countries  
**ε** = refers to the error term

## Result and Discussion

### *Descriptive Statistics*

The descriptive statistics for the panel data shown were summarized in Table 1. This provides an initial overview of the dataset and gives a basic understanding of the central tendencies, variability, and the range of values within the variables.

Table 1 presents the descriptive statistics of the brain drain index and related variables based on 872 observations across countries and years. The overall average brain drain index is 5.437, indicating moderate levels of skilled emigration, with noticeable variation across countries. This suggests that many countries continue to face challenges in retaining educated and skilled workers, though not at extreme levels overall. Regionally, Africa shows the highest and most consistent brain drain (mean = 6.916) followed by North America (mean=5.742), which also has the widest range and the highest recorded value (9.3).

Asia and South America reflect moderate brain drain levels of 5.436 and 5.321, respectively. Europe reports relatively lower levels (mean = 3.899), while Australia records the lowest and most stable brain drain (mean = 1.538), indicating strong retention and attraction of talent, likely due to its high-quality life, strong job market, and favorable immigration policies. These patterns emphasize regional disparities, with Africa facing the most persistent skilled emigration and Austria the least.

The global peace index has a mean of 2.008 and a low standard deviation of 0.439, indicating slight variation across countries. The global peace index has a mean of 2.008 and a standard deviation of 0.439, indicating limited variation across countries. The most peaceful observed score in the sample is 1.104, while the least peaceful score is 3.52. The average real minimum wage is \$10,098.06, with Belarus recording the highest (15.241) in 2015, and Uganda the lowest (1.554) in 2020. Carbon dioxide emissions per capita,

**Table 1.** *Descriptive Statistics*

Variable	Mean	Standard Deviation	Min.	Max.
Brain Drain (Overall)	5.437	1.943	0.5	9.3
Brain Drain (by Region)				
Africa	6.916	1.009	3.6	8.9
Asia	5.436	1.445	2	8.4
Australia	1.538	0.629	0.5	2.4
Europe	3.899	1.498	1.059	8.3
North America	5.742	2.774	1	9.3
South America	5.321	1.554	2.7	7.3
Global Peace Index	2.008	0.439	1.104	3.52
Real Minimum Wage	10098.06	198430.1	4.73	4160856
Carbon Dioxide per capita	4.291	4.739	0.024	31.806
Happiness Index	5.285	1.038	2.693	7.632
Gross Domestic Product	0.862	0.447	-3.53	2.82
Life Expectancy	0.557	0.319	-3.14	1.5
Corruption	0.275	0.313	0	0.966
Generosity	0.148	0.161	-0.326	0.838
Freedom	0.490	0.189	0	0.941
Social Support	0.981	0.326	0	1.601

*N*=872

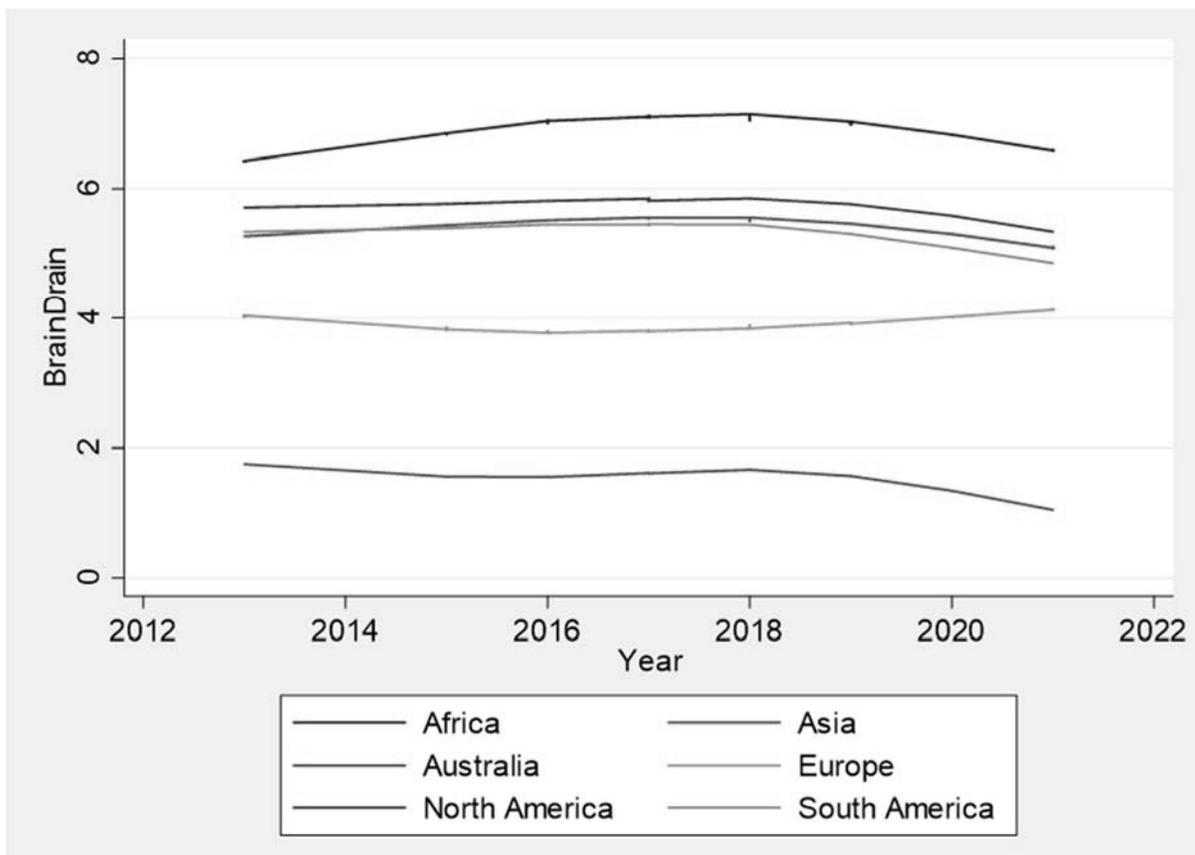
measured in log form, averaged 4.291 with a high variability (SD = 4.739). The highest emissions came from Trinidad and Tobago (31.81) in 2013, while the lowest were from the Central African Republic (0.024) the same year.

The happiness index has a mean of 5.285 and a standard deviation of 1.038. Finland scored the highest in 2021 at 7.84, whereas Afghanistan recorded the lowest at 2.52 in the same year. Within its components, GDP per capita averaged 0.862 (SD = 0.447), with Thailand reaching the highest score (2.82) and Malaysia the lowest (-3.53). Healthy life expectancy averaged 0.557 (SD = 0.319), with Thailand highest (1.5) and Lesotho lowest (-3.14). The absence of corruption averaged 0.275 (SD = 0.313), with Romania scoring highest at 0.97 and several countries scoring zero. Generosity averaged 0.148 (SD = 0.16), highest in Myanmar (0.838) and lowest in Greece (-0.326). Freedom had a mean of 0.490 (SD = 0.19), highest

in Switzerland (0.95), and lowest in Afghanistan and Angola (0.00). Social support averaged 0.981 (SD = 0.33), highest in Iceland (1.644) and lowest in Afghanistan, Central African Republic, and Togo (0.00). These statistics reflect wide global disparities in peace, income, emissions, well-being, and institutional quality.

**Trend Analysis: Brain Drain by Region**

Figure 3 shows the brain drain index trends from 2013 to 2021, presented by region. Africa consistently has the highest brain drain levels, peaking around 2018 before slightly declining. North America, Asia, and South America also exhibit relatively high and stable brain drain, with a mild downward trend after 2019. Europe shows a slightly lower and more stable brain drain throughout the period, whereas Australia maintains the lowest levels, with a gradual decline after 2018. Overall,



Source of Basic Data: Fund for Peace, 2024

**Figure 3**  
Brain Drain Trend by Region

the graph highlights persistent regional disparities, with Africa experiencing the greatest challenge in retaining talent and Australia has the strongest ability to retain its skilled workers.

### **Regression Results**

Based on the regression results shown in Table 2, the happiness index, global peace index, and real minimum wage are statistically significant in influencing the brain drain phenomenon. Consequently, the null hypotheses were rejected at 5% significance level. Furthermore, the R-squared is 0.5924, indicating that 59.24% of the variance in the dependent variable can be explained by the independent variables in the model. This suggests that the model has strong

predictive ability and indicates that the independent variables effectively explained the behavior of the dependent variable, brain drain.

The result shows that the happiness index negatively affects brain drain. This implies that for every one-point increase in the happiness index, the brain drain index decreases by 0.878 points considering all other factors constant. This is a response that naturally occurs when facing challenges in fulfilling basic needs. The desire for freedom to make life choices, a healthy life, strong social support, and an improved standard of living motivates people to look for opportunities in other places. It shows how humans always want a life that goes beyond just surviving; they seek happiness, well-being, and a better future.

**Table 2.** Pooled OLS Estimates With Clustered Standard Errors by Country and Year Fixed Effects (Model 1)

Variables	Coefficient
Happiness Index	-0.878*** (0.141)
Global Peace Index	0.849*** (0.237)
Real Minimum Wage	-2.92e-07*** (4.66e-08)
Carbon Dioxide Emission per capita	-0.117* (0.070)
Year	
2015	0.056 (0.057)
2016	0.079 (0.319)
2017	0.250*** (0.080)
2018	0.303*** (0.088)
2019	0.274*** (0.087)
2020	0.179* (0.096)
2021	0.079 (0.108)
Constant	8.721*** (0.819)
R-squared	0.5924
No. of Observation	872

Note: Robust Standard error in parenthesis

\*\*\* $p < 0.01$ , \*\* $p < 0.05$ , \* $p < 0.10$

This finding is supported by the findings of Polgreen and Simpson (2010), which indicated that there is a negative association between happiness and emigration, where happier countries have lower emigration rates than less happy ones. Happy individuals have fewer motives to migrate, whereas less happy people tend to seek better opportunities in other countries. In addition, the study by Brzozowski and Coniglio (2021) revealed the same findings, indicating that unhappy people were more likely to want to move abroad. The study also demonstrated that the average degree of happiness in a home and an individual's position in the family in terms of subjective well-being had a substantial influence on migration intentions.

Meanwhile, the global peace index has positive and statistically significant effects on brain drain. This implies that a one-point increase in the global peace index leads to an increase in brain drain by 0.849 points. The higher a country's global peace index, the less peaceful it is (Institute for Economics and Peace, 2023). This means that when a country becomes less peaceful, skilled individuals move to a more peaceful country. This is driven by several key factors, such as a decline in peace levels, which can raise safety concerns due to an increase in violence and conflict, making people prioritize their safety. Also, countries with higher GPI scores often face economic instability, leading to job insecurity and limited career opportunities. This motivates skilled professionals to seek more stable economic conditions abroad. Additionally, a lack of peace can negatively impact overall quality of life, causing stress and disruptions, further encouraging emigration.

The result is consistent with the findings of Seifi et al. (2020), which provided evidence that terrorism is one of the drivers of migration of skilled individuals. This finding is also supported by the empirical study by DiPietro (2013), which demonstrated that a stronger social stability, indicated by a higher peace level, leads to a reduction in brain drain. Increased peace within a nation correlates with lower risks of physical harm, property destruction, and societal unrest, rendering it a more favorable destination. Results also validated the theoretical framework, Lee's (1966) push-pull theory of migration, which provided that the peacefulness of the country attracts individuals to live, while a less peaceful country discourages migration. The Abraham Maslow (1943) hierarchy of needs also supports the finding as it also indicates that when individuals are

threatened, they tend to seek for other places that provide them with a sense of security.

Moreover, the results show that real minimum is statistically significant in explaining brain drain. It means that a substantial increase of \$10,000 in the real minimum wage is associated with a 0.00292 decrease in the brain drain index on average, holding other factors constant. This relationship is statistically significant at the 1% level, indicating strong evidence of a negative association between real minimum wage and brain drain. Put simply, when the minimum wage is higher, people are less inclined to leave the country. This is because a better minimum wage acts as a strong motivator for skilled individuals to stay in the home country. When they can earn a decent wage and enjoy a higher quality of life domestically, the desire to seek opportunities elsewhere diminishes. In essence, it is like a magnet that keeps skilled professionals from leaving, and this has significant implications for the country's talent retention and overall development. This observation is consistent with Boffy-Ramirez (2013), who found that an increase in minimum wage in the home state discourages migration, and states with higher minimum wages attract immigrants.

Additionally, Nwude (2013) found that highly qualified workers tend to seek better opportunities abroad where minimum salaries suffice their needs. Furthermore, these findings validated the push-and-pull theory of Lee (1966), which asserts that a higher expected minimum salary is a pull factor of migration. In accordance with Abraham Maslow's (1943) hierarchy of needs theory, a higher minimum wage contributes to fulfilling the physiological and safety needs reducing the necessity for migration driven by economic desperation.

On the other hand, carbon dioxide emissions per capita showed an inverse but statistically insignificant relationship with brain drain, as the coefficient is not statistically significant at the 5% level. This implies that, within the scope of this study, CO<sub>2</sub> emissions do not significantly influence skilled migration. Although this finding contrasts with most empirical studies that report a positive association between emissions and brain drain, it aligns with a few studies that found a negative but statistically significant relationship (e.g., Sheikheldin & Mohamed, 2014). These studies suggest that environmental degradation may deter potential migrants, though such effects appear context-dependent. In this model, the effect remains statistically

insignificant, indicating that CO<sub>2</sub> emissions per capita alone may not be a key determinant of brain drain.

For the time effects in Model 1, after controlling for important country characteristics, such as overall well-being measured by the happiness index, peace and safety captured by the global peace index, wage levels through real minimum wage, and environmental conditions reflected by carbon dioxide emissions, and after accounting for year fixed effects, the results show a significant increase in brain drain from 2017 to 2019. This means that even when these key factors are taken into account, brain drain continues to rise in the latter part of the decade. Although the results for the years 2020 and 2021 are not statistically significant, the positive values still suggests that brain drain may have continued to some extent, possibly reflecting ongoing movement before the full impact of the COVID-19 pandemic was felt.

In Model 2, a more detailed analysis is undertaken by replacing the happiness index with its component factors, which include GDP per capita, healthy life expectancy, and absence of corruption, generosity, freedom, and social support. This approach aimed to delve into the nuanced relationship between these factors of happiness and the brain drain, following the significant findings in Model 1, which revealed a strong connection between overall happiness and brain drain (see the regression analysis of Model 1 in Table 2).

Table 3 presents the regression results of the second model, an extension of the initial model that expands by incorporating the individual component indicators of the happiness index. This allows for a focused exploration of the happiness factors that play a significant role in influencing the migration decisions of skilled individuals. The independent variables were gross domestic product per capita, healthy life expectancy, absence of corruption, generosity, freedom, social support, global peace index, real minimum wage, and carbon dioxide emission per capita. The resulting R-squared is 0.6133, indicating that 61.33% of the variance of the brain drain index across countries and time can be explained by the independent variables in the model. This suggests that the model has a strong predictive ability, indicating that the independent variables can effectively explain brain drain.

Additionally, the brain drain remains as the dependent variable in this model. As shown in Table 3, the model explores how the sub-indicators of the happiness index influence brain drain. Among

these, healthy life expectancy exhibits a negative and statistically significant relationship with brain drain. Specifically, a one-unit increase in happiness attributed to healthy life expectancy reduces brain drain by 1.243 points. This suggests that individuals are more likely to stay in or move to countries where longer and healthier lives are possible. Higher life expectancy often reflects better healthcare systems, healthier lifestyles, and medical advancements. These are factors that attract skilled individuals seeking an improved quality of life. As a result, such conditions contribute to the movement of talent toward more developed countries.

This result is supported by the study of Popogbe and Adeosun (2020), which suggests that life expectancy and migration rate were found to be negatively correlated. Additionally, in accordance with the research by Akyildiz (2023), the results revealed a strong and substantiated causal (Granger) relationship between brain drain and life expectancy. Thus, the study conclusively posits that socioeconomic elements substantially impact the migration of skilled individuals from Turkey to the United States. This implies that skilled individuals consistently search for prospects to enhance their earnings and self-investment over time, thereby fostering a motivation to lead a longed and healthy life.

Another notable finding is the effect of corruption on brain drain. The result shows a statistically significant negative association, with a coefficient of  $-1.249$  at the 1% level, indicating that countries with lower corruption levels experience less brain drain. In other words, the presence of transparent, accountable governance helps retain skilled individuals, whereas high levels of corruption may push them to seek better opportunities abroad. This finding is supported by the study of Cooray and Schneider (2016), who found that corruption increases the emigration rate of highly educated individuals, as they are more mobile and in greater demand internationally.

Similarly, Arif (2022), using a gravity model, confirmed that less corrupt countries tend to attract more migrants and that corruption is positively associated with brain drain. These studies affirm that when individuals perceive their home institutions as corrupt, they are more likely to emigrate, particularly when they have the qualifications and resources to do so.

Moreover, social support is statistically significant and has a negative relationship with brain drain, with

**Table 3.** Pooled OLS Estimates With Clustered Standard Errors by Country and Year Fixed Effects (Model 2)

Variables	Coefficient
Gross Domestic Product per capita	-0.802 (0.537)
Healthy Life Expectancy	-1.243** (0.591)
Absence of Corruption	-1.249*** (0.351)
Generosity	0.351 (0.742)
Freedom	0.331 (0.689)
Social Support	-1.499*** (0.532)
Global Peace Index	0.774*** (0.226)
Real Minimum Wage	-2.55e-07*** ( 4.81e-08)
Carbon Dioxide Emission per capita	-0.109 (0.070)
Year	
2015	0.231*** (0.075)
2016	-0.449 (0.403)
2017	0.318 (0.433)
2018	0.340 (0.393)
2019	0.471 (0.421)
2020	0.125 (0.378)
2021	-0.702** (0.341)
Constant	7.289*** (0.798)
R-squared	0.6133
No. of Observation	872

Note: Standard errors in parentheses  
 \*\*\*p<0.01, \*\*p<0.05, \*p<0.1

a coefficient of -1.499, significant at the 1% level. This suggests that individuals who feel supported by their families, friends, and communities are less likely to leave their home country. The stronger the social ties and sense of belonging, the lower the tendency to emigrate. This reinforces the idea that brain drain is not only influenced by economic or institutional conditions but also by emotional and interpersonal factors. This result is supported by the findings of Theodori and Theodori (2014), who emphasized that the presence of family, close friends, and a sense of community strongly influences the decision to stay. Likewise, Eldridge and McKenzie (2013) found that many individuals, despite having access to better opportunities elsewhere, still expressed a deep attachment to their homeland and a desire to return to be with family and uphold cultural ties. These insights explain why social support significantly lowers brain drain in the current model.

Finally, the year effects in Model 2 show notable changes compared to Model 1, both in direction and statistical significance. It is important to note that Model 2 replaces the overall happiness index with its specific components, namely social support, freedom, generosity, healthy life expectancy, and absence of corruption. This allows for a more detailed understanding of how well-being factors influence brain drain. With these disaggregated variables included, the year effects that were previously significant in Model 1, particularly from 2017 to 2019, become insignificant. Only the year 2015 remains positive and significant at the 1% level with a coefficient of 0.231, whereas 2021 becomes negative and significant at the 5% level with a coefficient of -0.701. This shift suggests that much of the variation across years observed in Model 1 was actually explained by the specific components of the happiness index. The change in the sign and significance of the 2021 effect, in particular, indicates the potential influence of the COVID-19 pandemic, which likely contributed to a decline in brain drain during that year.

On the other hand, among the indicators of the happiness index, GDP per capita, generosity, and freedom exhibited statistically insignificant effects on brain drain in this model. In contrast, real minimum wage and the global peace index showed statistically significant relationships with brain drain, confirming their relevance as key predictors. These findings are consistent with the results reported in Model 1

(Table 2), reinforcing the robustness of their influence. Similarly, carbon dioxide emissions per capita showed a negative and statistically insignificant relationship with brain drain, mirroring the outcome reported in Model 1 (Table 2).

## Conclusion

In this research, it has been observed that the brain drain phenomenon is a substantial issue in all the countries examined. Existing literature primarily emphasized the impact of remittances on the economy but failed to recognize brain drain as a significant phenomenon, which can also be harmful to sustainable economic development. This singular focus overlooks the multifaceted challenges posed by the brain drain phenomenon.

Furthermore, the variables in this study have not been collectively investigated in prior research endeavors; thus, this comprehensive examination of brain drain is of great significance to understand its full impact on socioeconomic factors. Notably, the findings of this study demonstrate that brain drain is significantly and collectively explained by the global peace index, real minimum wage, carbon dioxide emission per capita, and the happiness index with its component indicators (gross domestic product and healthy life). Taking everything into account, the findings shed light on the complex dynamic of brain drain, emphasizing the broader impact beyond remittances and underscoring the need for a comprehensive approach to mitigate its effects on socioeconomic factors.

Lastly, the study only covers these macro-perspective independent variables (the real minimum wage, carbon dioxide emission per capita, global peace index, and the happiness index and its indicators, namely the GDP per capita, generosity, healthy life expectancy, social support, freedom, and absence of corruption) that analyze their impact towards the dependent variable, the brain drain index. However, it does not comprehensively account for all contextual factors specific to individual countries or regions, such as cultural or historical factors, which could also potentially impact human capital flight decisions.

## Recommendations

Given the significant influence of macro-level factors on brain drain as demonstrated in this study,

it is recommended that policymakers should adopt a multidimensional approach in addressing the problem of human capital flight that goes beyond economic incentives. Policy reforms must incorporate strategies to improve peace, environmental conditions, governance, and the overall well-being to retain and attract skilled individuals. In addition, future research expands the scope of analysis to include country-specific contextual variables such as cultural, political, and historical factors. Contextualizing the scope of analysis about brain drain would allow for a more comprehensive and nuanced understanding of the drivers behind human capital flight.

## References

- Aarhus, J. H., & Jakobsen, T. G. (2019). Rewards of reforms: Can economic freedom and reforms in developing countries reduce the brain drain? *International Area Studies Review*, 22\*(4), 327–347. <https://doi.org/10.1177/2233865919846725>
- Albarrán, P., Carrasco, R., & Carro, J. M. (2019). Estimation of dynamic nonlinear random effects models with unbalanced panels. *Oxford Bulletin of Economics and Statistics*, 81(6), 1424–1441. <https://doi.org/10.1111/obes.12308>
- Adeosun, O. T., & Popogbe, O. (2020). *Empirical analysis of the push factors of human capital flight in Nigeria*. <https://www.emerald.com/insight/content/doi/10.1108/JHASS-07-2020-0093/full/html>
- Assembly of European Regions (AER, 2020). Brain drain vs. brain gain. <https://aer.eu/brain-drain/>
- Adeyemi, R. A., Joel, A., Ebenezer, J. T., & Attah, E. Y. (2018, September 1). *The Effect of Brain Drain on the Economic Development of Developing Countries: Evidence from Selected African Countries*. [https://www.researchgate.net/publication/329814545\\_The\\_Effect\\_of\\_Brain\\_Drain\\_on\\_the\\_Economic\\_Development\\_of\\_Developing\\_Countries\\_Evidence\\_from\\_Selected\\_African\\_Countries?](https://www.researchgate.net/publication/329814545_The_Effect_of_Brain_Drain_on_the_Economic_Development_of_Developing_Countries_Evidence_from_Selected_African_Countries?)
- Ahmed, F., Ahmed, S., Ali, I., & Kousar, S. (2022). The environmental impact of industrialization and foreign direct investment: Empirical evidence from Asia-Pacific region. *Environmental Science and Pollution Research International*, 29(20), 29778–29792. <https://doi.org/10.1007/s11356-021-17560-w>
- Akyildiz, İ. E. (2023). Socio-economic determinants of brain drain from Turkey to the United States: The case of H-1B visa. *Journal of Management and Economic Research*, 21(2), 22–38. <https://doi.org/10.11611/yead.1217194>
- Apergis, N., & Payne, J. E. (2015). Renewable energy, output, carbon dioxide emissions, and oil prices: Evidence from South America. *Energy Sources, Part B: Economics, Planning, and Policy*, 10(3), 281–287. <https://doi.org/10.1080/15567249.2013.853713>
- Arif, I. (2022). Educational attainment, corruption, and migration: An empirical analysis from a gravity model. *Economic Modelling*, 110, 105802. <https://doi.org/10.1016/j.econmod.2022.105802>
- Baltagi, B. H. (2008). *Econometric analysis of panel data* (4th ed.). Wiley.
- Benček, D., & Schneiderheinze, C. (2024). Higher economic growth in poor countries, lower migration flows to the OECD – Revisiting the migration hump with panel data. *World Development*, 182, 106655. <https://doi.org/10.1016/j.worlddev.2024.106655>
- Boffy-Ramirez, E. (2013, September 3). Minimum wages, earnings, and migration. *IZA Journal of Development and Migration*, 2, Article number 17. <https://link.springer.com/article/10.1186/2193-9039-2-17>
- Blundell, R., & Bond, S. (1998). Initial conditions and moment restrictions in dynamic panel data models. *Journal of Econometrics*, 87(1), 115–143.
- Brzozowski, J., & Coniglio, N. (2021). International Migration and the (Un)happiness Push: Evidence from Polish Longitudinal Data. *International Migration Review*, 55(4), 1089–1120. <https://doi.org/10.1177/01979183211004835>
- Cameron, A. C., & Miller, D. L. (2015). A practitioner’s guide to cluster robust inference. *Journal of Human Resources*, 50(2), 317–372. <https://doi.org/10.3368/jhr.50.2.317>
- Chen, J., Fan, P., Ouyang, Z., Basnou, C., Pino, J., & Park, H. (2017). Nature-based solutions for urban landscapes under post-industrialization and globalization: Barcelona versus Shanghai. *Environmental Research*, 156, 272–283. <https://doi.org/10.1016/j.envres.2017.03.043>
- Cooray, A., & Schneider, F. (2016). Does corruption promote emigration? An empirical examination. *Journal of Population Economics*, 29\*(2), 290–310. <https://link.springer.com/article/10.1007/s00148-015-0563-y>
- DiPietro, W. R. (2013). *An International Empirical Look at a Few Possible Reasons for Brain Drain* (SSRN Scholarly Paper 2372602). <https://papers.ssrn.com/abstract=2372602>
- Fund For Peace. (2024). *E3: Human Flight and Brain Drain | Fragile States Index*. Fragile State Index. [https://fragilestatesindex.org/indicators/e3/?fbclid=IwAR3oO40GJoPxnwT7P\\_d-wrHQLnytqoyVWtsOb5GKmnYjUHZXgzmQ18q6cU](https://fragilestatesindex.org/indicators/e3/?fbclid=IwAR3oO40GJoPxnwT7P_d-wrHQLnytqoyVWtsOb5GKmnYjUHZXgzmQ18q6cU)
- Güngör, N. D., & Tansel, A. (2014). Brain drain from Turkey: Return intentions of skilled migrants. *International Migration\**, 52(5), 208–226. <https://doi.org/10.1111/imig.12013>
- Helliwell, J. F., Layard, R., Sachs, J. D., De Neve, J.-E., Aknin, L. B., & Wang, S. (Eds.). (2023). *World Happiness Report 2023* (11th ed.). Sustainable Development

- Solutions Network. <https://worldhappiness.report/ed/2023/>
- Institute for Economics & Peace. (2023). Global Peace Index 2023: Measuring peace in a complex world. Vision of Humanity. <https://www.economicsandpeace.org/report/global-peace-index-2023/>
- International Labour Organization. (2023). *World employment and social outlook: Trends 2023*. International Labour Office. [http://www.ilo.org/global/research/global-reports/weso/WCMS\\_865332/lang--en/index.htm](http://www.ilo.org/global/research/global-reports/weso/WCMS_865332/lang--en/index.htm)
- Ivlevs, A. (2014). *Happy moves? Assessing the impact of subjective well-being on the emigration decision* (Working Paper No. 20141402). Department of Accounting, Economics and Finance, Bristol Business School, University of the West of England. Retrieved from [https://ideas.repec.org/p/uwe/wpaper/20141402.html?utm\\_source](https://ideas.repec.org/p/uwe/wpaper/20141402.html?utm_source)
- Johnson, K. A. C. (2020). "Reconsidering Migration Transition Theory" by Karin A. C. Johnson. <https://pdxscholar.library.pdx.edu/hgipa/vol4/iss1/5/>
- Judson, R. A., & Owen, A. L. (1999). Estimating dynamic panel data models: A guide for macroeconomists. *Economics Letters*, 65(1), 9–15. [https://doi.org/10.1016/S0165-1765\(99\)00130-5](https://doi.org/10.1016/S0165-1765(99)00130-5)
- Lawal, L., Lawal, A. O., Amosu, O. P., Muhammad-Olodo, A. O., Abdulrasheed, N., Abdullah, K., Kuza, P. B., Aborode, A. T., Adebisi, Y. A., Kareem, A. A., Aliu, A., Elelu, T. M., & Murwira, T. (2022). The COVID-19 pandemic and health workforce brain drain in Nigeria. *International Journal for Equity in Health*, 21(1), Article 174. <https://doi.org/10.1186/s12939-022-01789-z>
- Lee, E. S. (1966). A theory of migration. *Demography*, 3(1), 47–57. <https://doi.org/10.2307/2060063>
- Lovo, S. (2014). Potential migration and subjective well-being in Europe. *IZA Journal of Migration*, 3(1), 1–18. <https://doi.org/10.1186/s40176-014-0024-5>
- Maslow, A. H. (1943). A theory of human motivation. *Psychological Review*, 50(4), 370–396. <https://doi.org/10.1037/h0054346>
- McKenzie, J., Jackson, A. P., Yazzie, R., Smith, S. A., Crotty, A. K., Baum, D., Denny, A., & Eldridge, D. B. (2013a). Career Dilemmas among Diné (Navajo) College Graduates: An Exploration of the Dinétah (Navajo Nation) Brain Drain. *The International Indigenous Policy Journal*, 4(4), Article 4. <https://doi.org/10.18584/iipj.2013.4.4.5>
- Magsi, H. (2014). Industrialization, environment and pollution. *The Diplomatic Insight*, 7, 24–26.
- Mott, G., Hamwey, R., & Razo, C. (2021, June 2). *Carbon emissions anywhere threaten development everywhere*. <https://unctad.org/news/carbon-emissions-anywhere-threaten-development-everywhere>
- Naz, S., Abro, M. M. Q., Aldakhil, A. M., Nassani, A. A., Sultan, R., & Zaman, K. (2019). Moderating and mediating role of renewable energy consumption, FDI inflows, and economic growth on carbon dioxide emissions: Evidence from robust least square estimator. *Environmental Science and Pollution Research*, 26(3), 2806–2819. <https://doi.org/10.1007/s11356-018-3837-6>
- Nguyen, Q.-L., Singh, A., Jain, S., & Shirchin, K. (2022). *Air pollution and emigration behaviors – evidence of Hanoi*. <https://doi.org/10.31219/osf.io/tcwb6>
- Nwude, C. (2013). The politics of minimum wage in Nigeria: The unresolved issues. *Asian Journal of Empirical Research*, 3(4), Article 4.
- Otrachshenko, V., & Popova, O. (2014). Life (dis)satisfaction and the intention to migrate: Evidence from Central and Eastern Europe. *Journal of Behavioral and Experimental Economics*, 48(C), 40–49.
- Pata, U. K. (2018). The effect of urbanization and industrialization on carbon emissions in Turkey: Evidence from ARDL bounds testing procedure. *Environmental Science and Pollution Research*, 25(8), 7740–7747. <https://doi.org/10.1007/s11356-017-1088-6>
- Polgreen, L. A., & Simpson, N. B. (2010). *Happiness and International Migration*. SpringerLink. <https://link.springer.com/article/10.1007/s10902-010-9229-3>
- Razin, A., Sadka, E., & Suwankiri, B. (2016). The welfare state and migration: A dynamic analysis of political coalitions. *Research in Economics*, 70\*(1), 122–142. <https://doi.org/10.1016/j.rie.2015.07.00>
- Ritchie, H., Roser, M., & Rosado, P. (2023). *CO<sub>2</sub> and greenhouse gas emissions*. *Our World in Data*. <https://ourworldindata.org/co2-and-greenhouse-gas-emissions>
- United Nations Conference on Trade and Development. (2012, November 26). *Report suggests mechanism for countering effects of brain drain from world's poorest countries*. United Nations. <https://unctad.org/press-material/report-suggests-mechanism-countering-effects-brain-drain-worlds-poorest-countries>
- Seifi, A., Motaghi, S., Ebrahim, S., & Ahmadi, M. S. (2020). Effect of terrorism activities on capital flight in the Middle East. *E3S Web of Conferences*, 157, 03017. <https://doi.org/10.1051/e3sconf/202015703017>
- Sheikheldin, G. H., & Mohamed, A. A. (2021). Skills for science systems in Africa: The case of brain drain. In R. Hanlin, A. D. Tigabu, & G. Sheikheldin (Eds.), *Building science systems in Africa: Conceptual foundations and empirical considerations* (pp. 135–161). African Centre for Technology Studies. <https://suraadiq.com/wp-content/uploads/2021/07/Skills-for-science-systems-in-Africa.pdf?>
- Smith, J. (2018). *Migration, productivity and firm performance: A report for the Migration Advisory Committee*. Migration Advisory Committee.

- [https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment\\_data/file/740988/Smith\\_2018\\_.pdf](https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/740988/Smith_2018_.pdf)
- Statistical, Economic and Social Research and Training Centre for Islamic Countries (SESRIC). (2014). The plight of human capital flight: Brain drain in OIC vs other country groups. SESRIC. <https://www.sesric.org/files/article/OIC%20Outlook%20Report-The%20Plight%20of%20Human%20Capital%20Flight.pdf>
- Theodori, A. E., & Theodori, G. L. (2014). Perceptions of community and place and the migration intentions of at-risk youth in rural areas. *Journal of Rural Social Sciences*, 29\*(1), 103–121. [https://www.researchgate.net/publication/281178178\\_Perceptions\\_of\\_Community\\_and\\_Place\\_and\\_the\\_Migration\\_Intentions\\_of\\_At-Risk\\_Youth\\_in\\_Rural\\_Areas](https://www.researchgate.net/publication/281178178_Perceptions_of_Community_and_Place_and_the_Migration_Intentions_of_At-Risk_Youth_in_Rural_Areas)
- Velciu, M. (2016). Human capital flight – Romania’s case. *SEA – Practical Application of Science*, (12), 573–579. <https://www.ceeol.com/search/article-detail?id=739837>
- Xu, X., & Sylwester, K. (2016). Environmental quality and international migration. *Kyklos: International Review for Social Sciences*, 69\*(1), 157–180.
- Xue, S., Zhang, B., & Zhao, X. (2021). Brain drain: The impact of air pollution on firm performance. *Journal of Environmental Economics and Management*, 110, 102546. <https://doi.org/10.1016/j.jeem.2021.102546>
- Zhou, Y., Yuan, B., Liang, B., Cui, Q., Zhang, S., & He, J. (2023). How does perceived environmental pollution affect migration interests: adapt or flee? *Applied Economics*, 55\*(19), 2146–2166. <https://doi.org/10.1080/00036846.2022.2102130>