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SOCIOECONOMIC DETERMINANTS OF BRAIN DRAIN FROM TURKEY TO THE UNITED STATES: THE CASE OF H-1B VISA[1]

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The notion of brain drain is indicated by the transfer of human capital, particularly highly educated talents, from developing countries to developed ones since high-skilled workforce often prefers to emigrate to countries with significant economic and industrial growth when deciding to leave their home countries. On the other side of the coin, welfare countries frequently offer "selected temporary skilled migration programs" to attract a skilled workforce. In this sense, the United States may be considered an exemplary country in attracting qualified human capital. The migration of skilled professionals from Turkey to the United States has been persisting since the 1960s. The present study attempted to propose a model for possible reasons for the brain drain from Turkey to the United States on the data of Turkish H-1B Visa holders between 1996 and 2019. The findings suggest a causal (Granger) relationship between brain drain and income, education, and life expectancy indices. Overall, it can confidently be asserted that the brain drain from Turkey to the United States is primarily instigated by economic, educational, and life expectancy factors.

Keywords: *Brain Drain, H-1B Visa, Toda-Yamamoto Causality Test, Highly Skilled Labor.*

Jel Codes: *F22, O15, K37.*

TÜRKİYE'DEN ABD'YE BEYİN GÖÇÜNÜN SOSYO-EKONOMİK BELİRLEYİCİLERİ: H-1B VİZE ÖRNEĞİ

ÖZET

Beyin göçü kavramı, beşeri sermayenin, özellikle yüksek eğitimli yeteneklerin, gelişmekte olan ülkelerden gelişmiş ülkelere transferini ifade etmekte çünkü yüksek nitelikli işgücü, kendi ülkelerinden ayrılmaya karar verirken genellikle önemli ekonomik ve endüstriyel büyüme gösteren ülkelere göç etmeyi tercih etmektedir. Madalyonun diğer tarafında, refah ülkeleri nitelikli bir işgücünü çekmek için sık sık "seçilmiş geçici nitelikli göç programları" sunmaktadır. Bu anlamda ABD, nitelikli beşeri sermayeyi çekme konusunda örnek bir ülke olarak değerlendirilebilir. Nitelikli profesyonellerin Türkiye'den ABD'ye göçü 1960'lardan beri devam etmektedir. Bu çalışma, 1996 ve 2019 yılları

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arasındaki Türk H-1B Vizesi sahiplerinin verileri üzerinden Türkiye'den ABD'ye beyin göçünün olası nedenleri için bir model önermeye girişmiştir. Bulgular, beyin göçü ile gelir, eğitim ve yaşam beklentisi endeksleri arasında nedensel (Granger) bir bağlantı olduğunu göstermektedir. Genel olarak, Türkiye'den ABD'ye beyin göçünün öncelikli olarak ekonomik, eğitim ve yaşam beklentisi faktörleri tarafından harekete geçirdiği rahatlıkla söylenebilir.

Anahtar Kavramlar: *Beyin Göçü, H-1B Vizesi, Toda-Yamamoto Nedensellik Testi, Yüksek Nitelikli İşgücü.*

Jel Kodları: *F22, O15, K37.*

1. INTRODUCTION

The term "brain drain" was first coined by the British Royal Society (Royal Society, 1963) to describe the exodus of scientists and technocrats to the United States (US) and Canada in the 1950s and early 1960s. After decades, this term was expanded to include the distinction between North and South and the issue of developing-developed between countries (Giannoccolo, 2004: 2). In the narrow sense, brain drain may be conceived of as the migration of highly skilled professionals from underdeveloped to wealthier countries. In a broader sense, the concept itself may be represented by the transfer of human capital, which is implied by the migration of highly educated people (e.g., engineers, physicians, and academics) from developing to developed countries (Docquier and Rapoport, 2006: 2).

There may be a variety of factors underlying what highly skilled workforce "flee" their home countries. On the supply side, the burden of unbearable socioeconomic conditions at origin and opportunities arising from globalization often encourage qualified individuals to congregate in lands with plentiful job vacancies. On the demand side, on the other hand, quality-selective immigration policies and higher financial expectations in other countries may push talents to leave their developing countries (Ngoma and Ismail, 2013: 745). One may understand reasonable motives behind why skilled people target developed countries as their destinations. For example, the US has always been the primary puller of talent for decades, particularly in the post-World War II era. The visa allocation system of the US often prioritizes employees with exceptional educational attainment or extraordinary skills or highly educated individuals from countries characterized as war zones, non-democratic regimes, and politically unstable territories. Especially tens of thousands of contract engineers, computer programmers, and medical personnel were hired temporarily after the enactment of the H-1B Immigration Act in 1990. Today, the H-1B visa serves as a conduit for immigrants (Portes and Celaya, 2013: 4-5). Thus, thousands of highly skilled immigrants, including physicians, nurses, engineers, and academics, settle in the US through this channel and contribute to the expansion of various sectors of the American economy. The immigrant management or professional experts with undergraduate or graduate education now consist of one-fourth of the foreign population in the US. Valid for three years, the H-1B visa program is

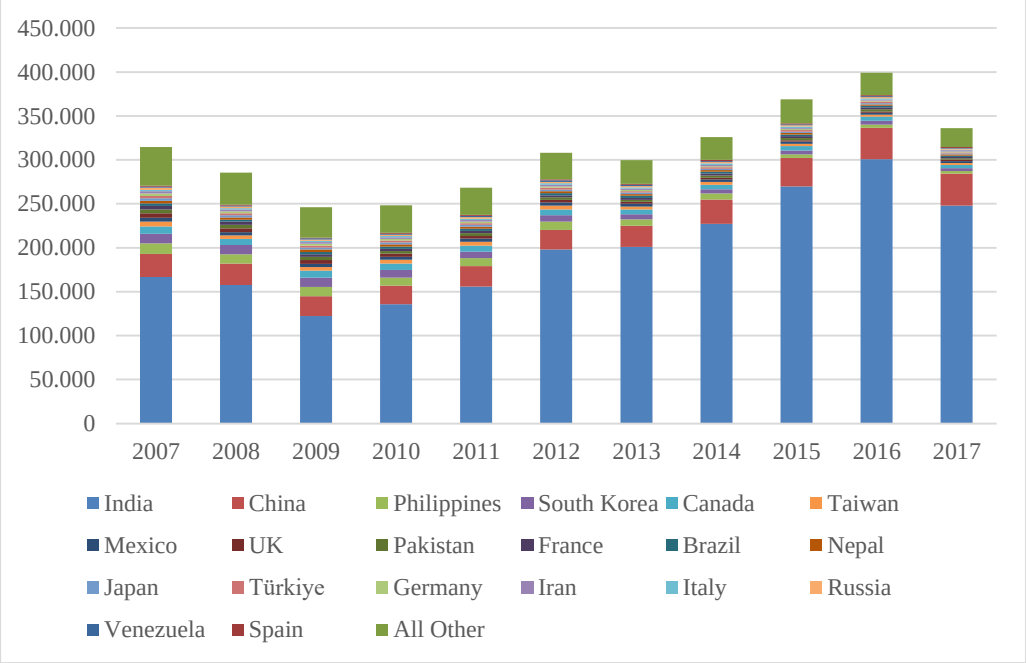
intended to encourage the immigration of highly skilled workers and may be extended once for a total stay of six years (Fulmer, 2009: 834).

Economically thriving countries have long been implementing "selected temporary skilled migration programs" to attract talent. Such programs can be exemplified as the Highly Skilled Migrant Program in the United Kingdom, the Economic Stream in Australia, the Green Card (IT Specialists Temporary Relief Program) in Germany, the Red-White-Red Card in Austria, Foreign Worker Program in Canada, and H-1B Program in the United States (AP, 2004: 38; Burmann et al., 2018: 46)[2]. The US has accepted skilled temporary non-immigrant workers through the "H1" program since 1952, but the original "H-1B" program was legislated in "The Immigration Act," dated 1990, to allow non-immigrant workers to be accepted in specialty occupations (e.g., medicine, law, and engineering; Smoske, 2018: 148). Hence, a non-immigrant person satisfying the following criteria will be qualified for a specialty occupation: "*(1) a bachelor's or higher degree or its equivalent is normally the minimum entry requirement for the position; (2) the degree requirement is common to the industry in parallel positions among similar organizations or, in the alternative, the position is so complex or unique that it can be performed only by an individual with a degree; (3) the employer normally requires a degree or its equivalent for the position; or (4) the nature of the specific duties is so specialized and complex that the knowledge required to perform the duties is usually associated with the attainment of a bachelor's or higher degree*." (USCIS, 2021: 2).

Despite pretty much interest in education and professional training in the Western regions since the early years of the republic, even the last periods of the Ottoman Empire, the brain drain is now a hot topic in today's Turkey. It is known that the US witnessed a heyday in the number of Turkish immigrants after the 1960s, thanks to its unequivocally pervasive policies toward attracting human capital to maintain its economic and political dominance in global markets. Turkish immigrants are also known to have settled in countries emulating the US with their immigration policies, such as Germany, New Zealand, Canada, France, Australia, and the United Kingdom (UK). Since the mid-90s, many exceptional academics, engineers, and physicians, leaving Turkey for economic and political instability, have long lived abroad, particularly in the US. Their success in the destination countries is even described as a "fetish of the successful Turks abroad" (Akçapar, 2009: 15-20).

[2] Highly skilled migration programs in some countries may have changed names, but their existence continues.

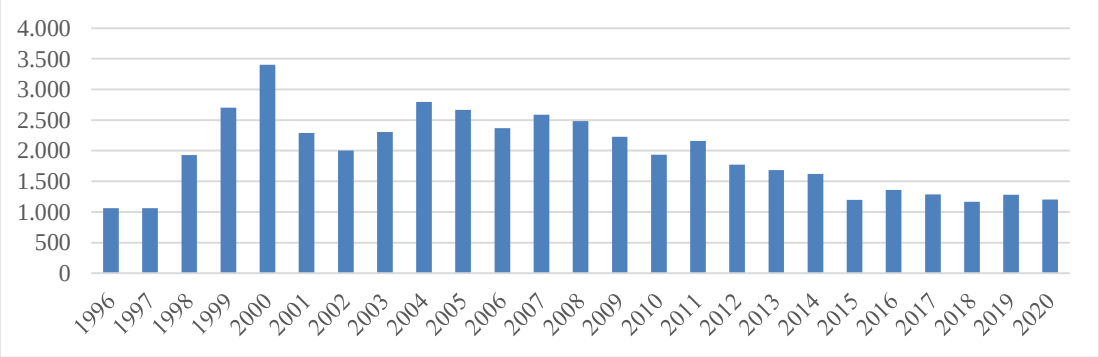
Figure 1. The Trend of H-1B Petitions



Source: Adapted from USCIS.

Figure 1 demonstrates the global distribution of H-1B petitions by origin country and the top 20 countries with a significant volume of H-1B visa requests between 2007-2017. Accordingly, India received the highest number of H-1B petitions, followed by China, the Philippines, South Korea, and Canada. Turkey ranked 14th among these countries regarding H-1B visa requests between the mentioned years.

Figure 2. Number of Turkish H-1B Visa Holders



Source: Adapted from DHS.

Figure 2 may imply the most recent picture of the Turkish brain drain to the US covers since an H-1B visa is only granted to highly skilled individuals. While the years 1996 and 1997 witnessed the immigration of 1000 highly educated people from Turkey to the US, this number seems to peak in 2000 with continuous increases in 1998 and 1999. Although the pace of the brain drain seems to have regressed in the subsequent years, the total number of highly skilled immigrants to the US between 1996 and 2020 represents a significant loss of human capital from Turkey. Indeed, the dissociation of human

capital costs too dearly to the origin country to maintain stable economic growth rates (OECD, 2010; Beine et al., 2003). To put it another way, the origin country misses the chance to capitalize on the knowledge and skills of its highly educated citizens since their departure will deprive the country of technological advances (Agrawal et al., 2011) and hinder its contribution to innovation and scholarly knowledge (Dodani and LaPorte, 2005). Overall, the present study was intended to offer an econometric analysis of socioeconomic factors underlying the brain drain from Turkey to the US. In this paper, while brain drain refers to people accepted for the H-1B visa, socioeconomic factors are considered indices pertinent to income, education, and life expectancy.

2. LITERATURE REVIEW

The Turkish literature hosts a plethora of research on brain drain, possibly because brain drain is among the principal issues of developing countries. Moreover, the scholarly community in such developing countries has long scrutinized the reasons for brain drain to guide policymakers to adopt relevant measures to restrain the pace of brain drain in the fight against its mid- and long-term adverse consequences in social, economic, and cultural domains.

Table 1. Turkish Research on Brain Drain

Authors	Year	Methodology	Factors Associated With Brain Drain
Oğuzkan (1971)	1968-1969	Survey	Professional, social-cultural, and economic factors
Glaser & Habers (1974)	1974	Survey	Economic - social motivations
Portes (1976)	1974	Survey	Political and economic imbalances
Kurtuluş (1999)	1999	Survey	Poor research opportunities: the thought of inability to find a good-paying job in Turkey
Akgün (2000)	1994-2000	Survey, Interviews	Better education opportunities, starting a business, and finding a better job.
Akçapar (2006)	2006	Interviews, Survey	Unsatisfactory financial opportunities, limited opportunities for remote work, and poor intellectual environment in the origin country
Güngör & Tansel (2008)	2002	Survey	Attractive compensation packages offered in host countries and lifestyle preferences
Kaya (2009)	2009	Comparative Analysis	Outdated scientific, economic, and technology-oriented policies and a distorted education system
Güngör & Tansel (2010)	2002	Survey	Economic instability in Turkey
Pazarcık (2010)	2009-2010	Survey	Favoring attractive welfare packages offered to academics abroad due to non-satisfying academic conditions in Turkey
Esen (2014)	2014	Interviews	Access to better education and academic opportunities
Mollahaliloğlu et al., (2014)	2009	Survey	Study/work abroad, better social opportunities, higher salaries, and access to better education abroad

Kaçar (2016)	2016	Interviews	Attractive job opportunities and access to better education
Ozcurumez & Aker (2016)	2011	Interviews	Better career opportunities and advancement prospects
Dedeoğlu & Genç (2017)	1960-2013	Gravity Model Analysis	Economic, demographic, and cultural factors
Acar (2017)	1980-2010	Panel Data Analysis	Gender, time, and educational attainment
Durmaz (2018)	2015-2016	Survey	Desirable academic opportunities
Elveren & Toksöz (2019)	2015-2016	Survey	Offensive labor market in Turkey
Karaduman & Çoban (2019)	2019	Survey	Access to better education, seeking better job and income opportunities, learning a language abroad
Aytaç & Çetin (2019)	2019	Survey	Ethnic discrimination, unemployment, state of insecurity, over bureaucracy, political and economic instabilities, and crisis in Turkey; exam-free access to better education overseas; political freedoms abroad
Atmaca (2020)	2019-2020	Interviews	Lack of trust, non-merit-based hiring and, administrative decisions; undervalued scholarly initiatives in Turkey
Okumuş (2020)	2020	Survey	Better career opportunities and expectations for a higher quality of life
Arslan & Okumuş (2021)	2021	Survey	Educational and work- and family-related reasons
Kuran (2021)	2020	Survey	Economic and educational reasons; threatening political climate of the country; lack of job opportunities at home; expectations of freedom, democracy, human rights, well-being, and high income in host countries
Aykaç (2021)	2017	Survey	Outdated academic programs and poor facilities and equipment for research in Turkey; desire to stay away from the depressing political environment in Turkey.

Although brain drain is mainly triggered by economic factors, followed by social and political factors (Table 1), the relevant literature in Turkey mostly hinges upon surveys and interviews, rather than econometric analyses, to explore the topic. The mentioned factors in brain drain are classified as pull and push factors in Table 2.

Table 2. Pull and Push Factors in Brain Drain

Pull Factors	Push Factors
* Better Job Opportunities	* Poor Working and Financial Conditions
* Attractive Compensation Packages	*Insufficient Academic Initiatives
* Employment Opportunities	* Political Insecurity
* Starting a Business	* Poor Financial Conditions in Academia
* Better Education Opportunities	* Ethnic Discrimination
* A Better Future	* Insufficient Access to Domestic Human Rights and Democracy
* Social Well-being Practices	
* Learning a Language	
* Enjoying Political Freedoms	

Source: This table was created by the author.

Turkey is known to be among the countries with the highest rate of brain drain across the world. It experienced the trend of brain drain in the 1960s with the immigration of highly educated talents, such as physicians, engineers, and academics, and has been losing its skilled labor force ever since (Kaya, 2009: 18-19). As mentioned, brain drain finds a seat itself among the issues in the political agenda of not only Turkey but also other states. Although brain drain seems to be a problem of developing countries primarily, it is also likely to affect developed countries. For example, skilled workers emigrate from Canada to the United States to attain higher wages with lower taxes.

Brain drain has a significant impact on the competitiveness of countries around the world. On the side of host countries, the supply of employees with desirable skills is more likely to boost such countries' ability to capitalize on consolidated human capital to attain robust competitiveness (Bris & Caballero, 2015: 1-2). Conversely, brain drain may lead origin countries to encounter a loss of competitiveness, fewer tax revenues, technological gaps, and labor force shortages in key economic activities. On the other hand, brain drain may bring positive implications to the development of origin countries. Remittances from workers can replenish the human capital stock. Moreover, the diaspora with positive externality can ameliorate bilateral relations and trade. Circular migration also contributes to bilateral shares of acquired knowledge and experience (Docquier, 2014: 5-7).

Since the 1960s, the US has enjoyed highly educated human capital from developing countries, particularly from Turkey. The academic and political agendas of countries with abundant young talents, such as Turkey, are always occupied with strategies for tackling the brain drain. Limited to those holding an H-1B visa, the present study attempted to investigate the main socioeconomic determinants of brain drain from Turkey to the US. Although the topic was previously scrutinized by adopting survey and interview methods primarily, the adoption of econometric analysis of the pillars of the human development index (HDI) to examine the issue may be considered the distinct contribution of this study.

3. DATA AND METHODOLOGY

In this study, we explored the relationship between brain drain from Turkey and underlying economic and social factors among highly skilled H-1B visa holders between 1996-2019 through the pillars of the HDI data (e.g., income, education, and life expectancy). While the dependent variable, brain drain, was considered the rate of Turkish individuals granted an H-1B visa by the US, we determined the independent variables as Turkey's HDI data (income, education, and life expectancy). The Toda-Yamamoto (1995) causality test was utilized in the empirical analysis of the data. Prior to proceeding to the causality analysis, we tested the series for the presence of a unit root with the help of the Augmented Dickey-Fuller test. It is known that while the Granger (1969) causality testing requires both series be stationary, the Toda-Yamamoto test does not (1995), referring to the fact that the series can be included in the analysis regardless of their degree of stationarity.

To apply the Toda-Yamamoto (1995) test, the lag length (l) must first be determined using the VAR model. In the following step, the maximum stationarity level (dmax) is added to the lag length (l). In this case, the relevant VAR model can be expressed as follows.

$$X_t = a + \sum_{i=1}^{l+dmax} \beta_i Y_{t-i} + \sum_{j=1}^{l+dmax} \gamma_i X_{t-j} + u_{yt}$$

$$Y_t = a + \sum_{i=1}^{l+dmax} \theta_i X_{t-i} + \sum_{j=1}^{l+dmax} \delta_i Y_{t-j} + u_{xt}$$

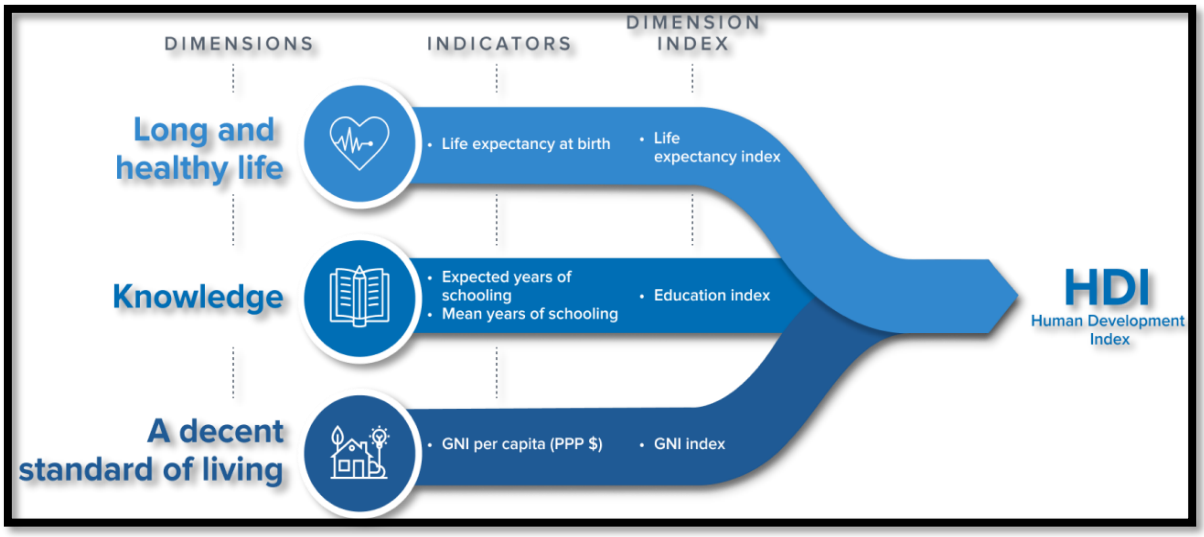
H_0= X is not the Granger cause of Y.

H_1= X is the Granger cause of Y.

Table 3. Specifications of the Research Variables

Variables	Description	Transformation	Source
H-1B	Turkish Skilled Labor Force Receiving H-1B Visa	The rate of total H-1B visas to Turkish people	DHS and USCIS
Income_Ind	Income Index	Index Rate	UNDP
Edu	Education Index	Index Rate	UNDP
Life	Life Expectancy Index	Index Rate	UNDP

Figure 3. HDI Dimensions and Indicators



Source*:* Adapted from UNDP.

While life expectancy at birth, also known as the "life expectancy index," is designed to assess health, the "education index" measures education by average years of schooling for adults aged 25 years and above and expected years of schooling for school-age children. In the HDI, the standard of living is evaluated based on gross national income per capita (GNI), also known as the "income index" (UNDP, 2021). Overall, HDI is a summary measure of average achievement in key dimensions of human development: "*a long and healthy life, being knowledgeable, and having a decent standard of living*" (Figure 3; UNDP, 2023).

Table 4. Summary Stats of the Variables

	H-1B	Edu	Income	Life
Mean	0.755417	0.583375	0.795500	0.819167
Median	0.800000	0.552500	0.795500	0.822000
Maximum	1.100000	0.731000	0.850000	0.888000
Minimum	0.300000	0.435000	0.746000	0.732000
Std. Dev.	0.242558	0.097905	0.036072	0.047769
Skewness	-0.499474	0.222348	0.162061	-0.241851
Kurtosis	1.927889	1.718636	1.622083	1.894086

4. RESULTS

We initially checked the stationarity of the series using the Augmented Dickey-Fuller (ADF) test (Dickey & Fuller, 1981) and the Philips-Perron (PP) unit root test (Phillips & Perron, 1988) before applying the Toda-Yamamoto test to the research variables.

Table 5. Results of Unit Root Tests

		ADF		PP	
	Variables	**Constant**	**With Constant & Trend**	**Constant**	**With Constant & Trend**
At Level	H-1B	-0.3153	-1.7767	-0.1886	-1.5398
	Income	-0.0443	-5.5467***	-0.0644	-2.2796
	Education	0.1150	-4.4268**	0.3345	-1.6502
	Life expectancy	-2.9759*	-1.5751	-8.3030***	-1.3627
At First Difference	H-1B	-4.7617***	-5.3035***	-4.7694***	-6.5063***
	Income	-4.2637***	-4.2577***	-4.2648***	-4.2581**
	Education	-2.4295	-2.4516	-2.6925*	-2.6093
	Life expectancy	-0.8335	-2.7918	-0.3105	-2.7760
Critical values	1 % 5 % 10%	-3.752946 -2.998064 -2.638752	-4.416345 -3.622033 -3.248592	-3.752946 -2.998064 -2.638752	-4.416345 -3.622033 -3.248592

Notes: (*) Significant at 10%; (**) Significant at 5%; (***) Significant at 1%.

Table 5 presents the results of the ADF unit root test. The Toda-Yamamoto test, a revised form of the Ordinary Granger causality test, was adopted in this study thanks to its suitability for series stationary at different orders. Accordingly, it may be straightforward to say the dependent variable H-1B is the integrated order of 1 at conventional significance levels. Education, life expectancy, and income are I (0) considering the ADF unit root test for the model with constant and trend. Yet, income is the integrated order of 1 when checking the results of the ADF and PP tests.

Table 6. Lag Length Selection for the VAR Model

Lag	LogL	LR	FPE	AIC	SC	HQ
0	189.7662	NA	5.44e-13	-16.88784	-16.68947	-16.84111
1	325.4077	209.6277*	1.06e-17	-27.76433	-26.77248*	-27.53068
2	345.1711	23.35679	8.95e-18*	-28.10646*	-26.32112	-27.68589*

In Table 6, while the appropriate lag number of the model was 1 considering the Schwarz Information Criterion (SC) and the Sequential Modified LR Test Statistic (LR), it became 2 according to the Akaike Information Criterion (AIC), the Hannan-Quinn Information Criterion (HQ), and the Final Prediction Error (FPE). We then considered the SC and the LR criteria; thus, our econometric analysis

findings would be more significant in lag number 1. Besides, the LM test showed no autocorrelation in the VAR analysis with a lag number of 1, implying the model was free of any autocorrelation issues (Table 7).

Table 7. Result of Autocorrelation LM Test

Lag	LM Statistics	df	*p*
1	17.50209	16	0.3538
2	18.71915	16	0.2835
3	11.97727	16	0.7455

Figure 1. Inverse Roots of AR Characteristic Polynomial

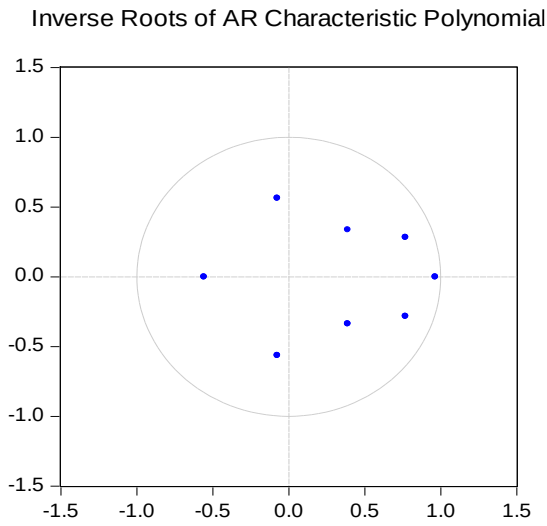


Figure 1 also demonstrates the stationary nature of our VAR model since all of the inverse roots of the AR characteristic polynomial fell inside the unit circle. Moreover, the results documented no heteroscedasticity problem in the model (Table 8).

Table 8. VAR Residual Heteroscedasticity Tests

Chi-sq	df	*p*
147.8384	160	0.7455

Table 9. Toda-Yamamoto Causality Test Results

Direction of Causality	Chi-square	*p*	Hypothesis	Granger Causality
Income > H-1B	48.02748	0.0000	Income is not the Granger cause of H-1B **H_0 rejected**	A causal relationship between the income index to brain drain
Education > H-1B	21.37137	0.0000	Education is not the	A causal relationship between the education index and brain drain

			Granger cause of H-1B **H_0 rejected**	
Life expectancy > H-1B	30.03280	0.0000	Life expectancy is not the Granger cause of H-1B **H_0 rejected**	A causal relationship between the life expectancy index to brain drain

The Toda-Yamamoto causality test results, shown in Table 9, revealed a causal (Granger) relationship between brain drain and income, education, and life expectancy. In other words, our analysis showed that socioeconomic factors (economic, educational, and life-related indices in this study) significantly predict brain drain. The causalities between brain drain and the mentioned indices were also found to be highly robust at a significance level of 1%.

5. CONCLUSION

Brain drain, referring to the immigration of highly skilled employees from developing to developed countries, has been one of the major threats to developing countries. The socioeconomic imbalances in the origin country and the mesmerizing opportunities in the destination country have always enticed highly qualified individuals to migrate. Besides, welfare states implement a variety of immigration policies to attract skilled workers across the world, such as selected temporary skilled migration programs. Particularly the US, followed by European states, has attained a remarkable achievement in attracting highly skilled people thanks to such migration policies to elevate their global economic and human capital dominance. Compensation packages and other social opportunities in temporary migration programs have drawn skilled workers to the US like a magnet. To date, Turkey has not been free of such a brain drain wave to the US. The brain drain from Turkey to the US has been a hot issue for the country since the 1960s, and the Turkish young now seem to maintain this trend. In the literature, while the reasons for the brain drain from Turkey between the 1960s-2000s were primarily shown as financial difficulties, professional concerns, and political instability, they have been characterized by poor economic, educational (access to better education and nurturing academic conditions), and political outlook in Turkey since 2000s.

In this study, we explored the brain drain from Turkey to the US with underlying socioeconomic factors using the data of Turkish H-1B visa holders between 1996-2019 with the pillars of the HDI. Our findings uncovered a robust causal (Granger) relationship between brain drain and income, education, and life expectancy. Thus, we can confidently assert that socioeconomic factors significantly affect brain drain from Turkey to the US. In general, the previous research showed financial reasons as the prominent predictor of brain drain from Turkey, followed by educational-professional concerns. Social and

political factors cannot also be thought to be independent of the mentioned reasons. Thus, it seems that our findings overlap with what was previously concluded in the relevant literature. One difference in our research from those in the literature may be that health-related (life expectancy) factors were found to predict the migration of Turkish talents to the US.

To acquire a relatively clear insight into brain drain, one may need to consider the actual picture of the pillars (income, education, and life expectancy) of the HDI between the origin and destination countries since skilled individuals always seek opportunities to earn more and invest in themselves in the long run, which stimulates the desire to live a long and healthy life. Turkey is one of the countries with the highest rate of brain drain. As income- and education-related factors seem to have major roles in the migration of highly skilled people from Turkey, the government may be recommended to adopt relevant educational policies and GNI-boosting initiatives must be adopted to protect the country from adverse impacts of brain drain. The metaphor commonly used in migration literature, "once the migration tap is turned on, it cannot be turned off immediately," implies that brain drain is a drastic fact for every country but can be minimized thanks to appropriate policies.

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