Original Article

The impacts of climate change, socio-economic, political, and demographic factors on international migration in Asia

Huynh Hien Hai[*]

Ho Chi Minh City University of Industry and Trade, Vietnam
No. 140, Le Trong Tan Street, Tay Thanh Ward, Ho Chi Minh City

Abstract: Migration has been a major concern in Asia for the past three decades, with international migration being more widely studied than migration resulting from climate change factors, such as temperature, rainfall, CO_2 emissions, and other environmental factors. To address this gap in the literature, a study was conducted using random effects, fixed effects, and generalized least squares regressions for the short run, as well as FMOLS, DOLS, and CCR regressions for the long run, to investigate the effects of climate change and key economic factors on migration in a sample of Asian countries from 1990 to 2020, using five-year interval data. The findings showed that climate change factors, including temperature and rainfall, have had a significant and positive impact on migration from these Asian nations. Additionally, in the short run, the results also identify the cointegrating effects of economic, social, political and demographic factors on international migration. The economic growth, rule of law, and population density have contributed to the increase in migration over the past three decades; meanwhile both rule of law and population density positively affect international migration in the long run.

1. Introduction

While research on migration theories still draws its scientific foundations from the early industrial revolution periods, such as Ravenstein (1885) and Lee (1966), these theories tend to be relatively straightforward. They primarily emphasize labor movement driven by economic factors and the industrialization process, as exemplified by Harris-Todaro (1970). Although more recent studies have shifted focus to acknowledge the importance of environmental, economic, social, political, and demographic factors in migration (Black et al., 2011), a comprehensive and systematic analysis and synthesis of these factors is still lacking. Massey et al. (1993) argue that migration serves as a household strategy for diversifying income streams and hedging against climate-related economic uncertainties and shocks. By having a family member migrate to another location, households can rely on remittances as a stable income stream, even if economic conditions deteriorate in their home community. Migration becomes a self-insurance strategy, especially when household members are sent to international destinations with uncorrelated weather and market conditions (Massey et al., 1993).

Recent empirical research on migration shows that many authors continue to focus on economic factors, such as income and economic growth, as key drivers of migration (Tombe & Zhu, 2019; Cottier & Shinghal, 2019; Tomohara, 2019; Czaika & Parsons, 2017; Raymer et al., 2019). However, an increasing number of studies have shifted their attention to climate factors, including temperature, precipitation, and environmental degradation issues, such as global warming, the greenhouse effect, and other environmental factors influencing international migration flows (Falco et al., 2019; Cattaneo et al., 2019; Mueller et al., 2020; Sloat et al., 2020; AboElsoud et al., 2020; Beyer et al., 2022; Schneider, 2022; Withers et al., 2022; Minehan & Wesselbaum, 2023). Despite this growing focus, much of the research still centers on regions such as Europe, OECD countries, the United Nations, China, and India, with little systematic attention given to environmental migration in other Asian countries.

Asia hosts a large number of international migrants, and climate change is expected to significantly impact migration in the region. People migrate for various reasons, including economic opportunities, family reunification, education, conflict, and environmental factors. As global warming, extreme weather events, and environmental degradation become more common, climate change is likely to displace people and force migration. According to the UN (2021), there were 280 million migrants worldwide in 2020, representing 3.6 per cent of the global population, up from 2.8 per cent in 2000. Asia, in particular, is heavily affected by global climate change (UN, 2020). This paper aims to contribute to understanding how international migration can be influenced by economic, social, environmental, political, and demographic factors through various complex interrelationships.

2. Literature review

Some studies have started to emphasize the environmental aspects of migration in comparison to other socio-economic factors (Begossi, 1999; Curran & Agardy, 2002). Research has shown that adverse climatic conditions can increase the risk of international out-migration (Feng & Oppenheimer, 2012; Gray & Bilsborrow, 2013; Hunter et al., 2013; Nawrotzki et al., 2013). However, these studies have primarily focused on Latin America, which may be partly due to the region's unique historical, economic, social, and political context (Kaenzig & Piguet, 2014). Additionally, climate-related economic recessions may reduce international migration and trap people in place (Black et al., 2011). The relationships between climate, environmental changes, and migration are complex and multi-dimensional, involving economic, political, and social factors such as governance, policy, and access to resources.

Climate change has become a significant factor influencing migration. Temperature and rainfall are the most widely used climate variables in empirical studies on migration at the macro level (Backhaus et al., 2015; Thiede et al., 2016; Mastrorillo et al., 2016; Beine & Parsons, 2017; Jha et al., 2017; Nawrotzki & Bakhtsiyarava, 2017; Dallmann & Millock, 2017; Falco et al., 2018; Sloat et al., 2020; Sedova & Kalkuhl, 2020; Mueller et al., 2020). Chen and Mueller (2019) find that climate impacts are most pronounced in urban areas, where a standard deviation increase in temperature and a decrease in rainfall lead to declines in out-migration by 10 per cent and 12 per cent, respectively, relative to mean values. Other studies have found that increases in temperature and/or rainfall in a sending country are associated with increased migration flows to destination countries (Marchiori & Cantoni, 2015; Backhaus et al., 2015). Long et al. (2022) noted that carbon emissions positively impact internal migration in China. Recent research continues to yield interesting results regarding the intersection of migration with climate change, economic, social, and other factors. Moreover, Mueller et al. (2020) emphasize the need to understand temperature and precipitation when analyzing their links to migration. Agba et al. (2021) found that climate change has a strong impact on agriculture and livelihoods in African countries, presenting significant challenges for adaptation. Minehan and Wesselbaum (2023) show that temperature has significant effects on migration flows towards OECD countries.

Furthermore, economic factors continue to be analyzed in relation to international migration. AboElsoud et al. (2020) argue that there is an interrelationship between migration factors, unemployment, and GDP per capita in Australia. Muñoz-Mora et al. (2020) find that Venezuelan immigration positively influences self-employment and own-account workers but negatively affects employers. They also note a long-term positive relationship between migration and GDP per capita growth. Schneider (2022) shows that migration contributed positively to regional convergence in the European Union, with each percentage point of net migration increasing GDP per capita by roughly 0.01 per cent and reducing unemployment by 0.1-0.2 percentage points.

In terms of the social factor on international migration, Espinosa and Díaz-Emparanza (2021) found a co-integrated and positive relationship between unemployment and migration. Thomas (2019) argues that migration is closely linked to the labor market and employment. Arisman et al. (2020) suggest that Malaysia should pay more attention to existing regulations to create a more favorable working environment.

On the other hand, Achtnich (2022) found that violence, imposition, and the role of government have significant implications for migration in Libya. Withers et al. (2022) highlight the pandemic as an unprecedented challenge to the migration-development nexus in South Asia and examine its economic implications for three remittance-dependent economies: India, Nepal, and Sri Lanka. However, studies have not yet sufficiently addressed the political aspects of international migration.

When considering the demographic factors of migration, there are differing findings regarding population effects. Bang and MacDermot (2018) show a positive relationship between population and migration, while Macková et al. (2019) illustrate a negative effect of population on immigration. Adedoyin et al. (2020) investigated the relationship between governance performance and migration across 23 European countries from 1998 to 2017.

In general, migration results from the combined influence of factors such as economic, political, social, environmental, and demographic elements (Black et al., 2011). Beyer et al. (2022) also agree that migration is closely linked to climate change, economic factors, social factors, and other elements. Based on the theoretical framework and previous research, this study proposes a framework for analyzing factors affecting migration, including climate factors (temperature, rainfall, carbon emissions), social factors (unemployment), economic factors (economic growth), demographic factors (population density), and policy factors (rule of law), as shown in Figure 1. This literature review identifies a research gap in understanding the relationship between migration, climate change, and economic indicators. This gap justifies the need for this study for the following reasons:

First, despite growing research, there remains a limited understanding of the connection between the environment and migration and the mechanisms driving this relationship. Various theories attempt to explain how and why climate change affects migration decisions. Beyond disrupting livelihoods, especially for agricultural households that depend heavily on environmental conditions for income, climate change can influence migration through other channels.

Second, the Asian region is characterized by its diversity and vulnerability to climate change and environmental degradation. The region's densely populated coastlines, heavy reliance on agriculture, forestry, and natural resources, along with high levels of extreme poverty, make it particularly susceptible to the negative impacts of climate change. Failure to adapt could hinder development, especially in countries dependent on natural resources. Therefore, economic and environmental factors remain pivotal in addressing global migration issues.

Third, there appears to be a lack of extensive research that comprehensively and thoroughly analyzes the economic, social, environmental, political, and demographic factors related to international migration, particularly in Asian countries.
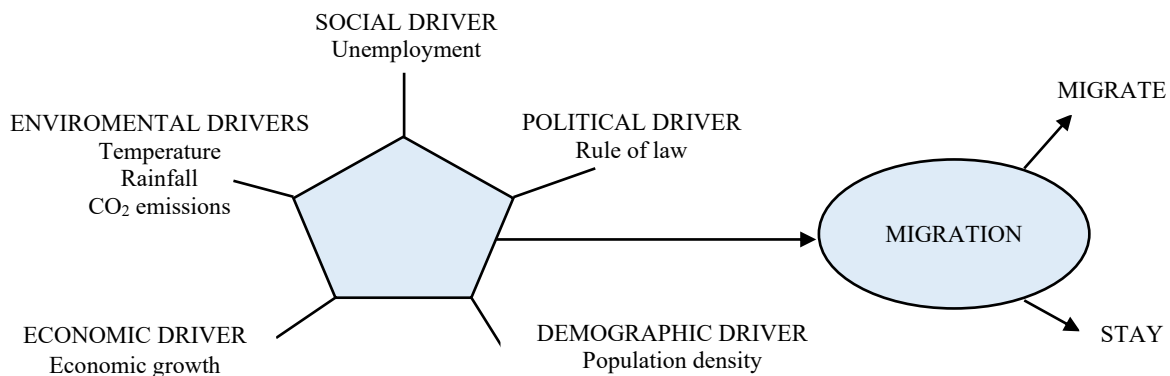

Figure 1: The theoretical framework of the impacts of climate change and socio-economic factors
on international migration.
Source: The authors' adaptation from Black (2011).

3. Method

This study examines the effects of climatic, socio-economic, political, and demographic factors on migration (Marchiori et al., 2015; Mueller et al., 2020; Backhaus et al., 2015). While other studies often focus either on short-term or long-term aspects, this study integrates both by considering short-term impacts and long-term considerations with appropriate lags. We employ the fully modified OLS (FMOLS) technique introduced by Phillips and Hansen (1990), as well as dynamic OLS (DOLS) and canonical cointegrating regression (CCR) methods advocated by Stock and Watson (1993). These methodologies ensure asymptotic coherence by accounting for serial correlation effects. The FMOLS, DOLS, and CCR tests are applicable only when the condition of cointegration among the variables is satisfied. Therefore, we estimate long-term elasticity using FMOLS, DOLS, and CCR estimators. The study investigates the impacts of climate change on international migration in Asian countries using five-year interval data from the United Nations (due to the limitation of migration surveys). This research employs the random effects, fixed effects, and generalized least squares (GLS) regression for short-term analysis, and FMOLS, DOLS, and CCR regressions for long-term analysis, with appropriate lags, following the model outlined below:

$$MIG_i = \beta_0 + \beta_1 TEM_i + \beta_2 RAI_i + \beta_3 CO2_i + \beta_4 ROL + \beta_5 UNEMP_i + \beta_6 GROW_i + \beta_7 DENSITY_i + u_i$$

where: MIG_j is net migration rate by country (per 1,000 population); TEM_i is an average temperature by country (^0C); RAI_i is logarithm of rainfall by country (mm); $CO2_i$ is logarithm of the CO_2 emissions ($MtCO_2$); ROL_i is the rules of laws (points); $UEMMPL_i$ is the unemployment, total (% of the total labour force); $GROW_i$ is Economics growth (percent); $DENSITY_i$ is logarithm of the population density (people) which were collected from World Bank, United Nations, International Labor Organization and Global Carbon Project.

Temperature and rainfall have been extensively studied at the macro level. For instance, Falco et al. (2018), Beine & Parsons (2019), Cattaneo et al. (2019), Sloat et al. (2020), Mueller et al. (2020), and Sedova and Kalkuhl (2020) examine the relationship between temperature and migration in the context of climate change. Similarly, Mastrorillo et al. (2016), Jha et al. (2017), Dallmann and Millock (2017), Nawrotzki and Bakhtsiyarava (2017), Falco et al. (2018), Mueller et al. (2020), and Sedova and Kalkuhl (2020) investigate the impact of rainfall on migration trends. Marchiori et al. (2015) and Backhaus et al. (2015) indicate that higher temperatures and greater precipitation in a sending country are associated with increased migration flows to the destination country. Additionally, Alesky et al. (2022) and Rafiq et al. (2017) explore the relationship between migration and environmental factors, including CO2 emissions. The role of the rule of law positively affects net migration (McConnon, 2020; Hasnat et al., 2022; Withers et al., 2022). Population density also positively impacts net migration (Blachaus et al., 2015; Rafiq et al., 2017; Guzi & Mikula, 2022), as do other economic factors (Bang & MacDermot, 2018; Macková et al., 2019; Raymer et al., 2019).

4. Results

4.1. The descriptive statistics and some tests

According to the summary statistics, the TEM variable was 18.96^0C average. In this series, the highest in Bahrain was 29.09^0C in 2010, while the lowest in Mongolia in 2010 was -0.42 per cent. The variable of MIGRATION was 329 observations. In this series, the highest in Qatar was 134.414 per mille in 2010, while the lowest in Kuwait in 1995 was -70.79 per mille. GROW variable has an average of 4.22 per cent in the period discussed. In this series, the highest in Iraq in 1990 was 58.10 per cent, while the lowest was observed in the Maldives in 2020 by -33.5 per cent. The variable of UNEMPL was 329 observations. In this series, the highest in Armenia was 21.21 per cent in 2020, while the lowest in Qatar in 2015 was 0.17 per mille. And the ROL variable was -0.29 points in the average when the highest value was 1.88 and the lowest value -2.07 points; the DENSITY variable was 4.57, with the highest value 9.03 and the lowest value 0.34. Beside that, the results from the multi-collinearity test. Again, the results indicate that multi-collinearity is not a significant issue in this research.

The Wooldridge and the Breusch-Pagan/Cook-Weisberg tests are used to investigate the autocorrelation and heteroscedasticity in our sample. Results confirm that autocorrelation is present in our sample. Similarly, heteroscedasticity is present in the regression model. GLS is used to deal with situations in which the OLS estimator is not BLUE (best linear unbiased estimator) because one of the main assumptions of the Gauss-Markov theorem, namely that of homoskedasticity and absence of serial correlation, is violated.

3.2. Results of the factors affecting migration in the short run

Therefore, in addition to using re and fe regression, and the GLS regression which can better handle the autocorrelation and heteroscedasticity. Results are shown in Table 1.

Table 1: Empirical results on the factors affecting migration using random-effects, fixed-effects, and the GLS estimations in the short run

Variables	Random effect (1)	Fixed effect (2)	GLS (3)
	MIGRATION	MIGRATION	MIGRATION
TEM	**0.33770****	0.64475	**0.33770****
RAI	**-6.41316*****	-22.54784***	**-6.41316*****
CO2	-0.29051	0.79794	-0.29051
ROL	**4.26195*****	5.30136	**4.26195*****
UNEMPL	-0.23597	0.60511	-0.23597
GROW	**0.31879*****	**0.53176*****	**0.31879*****
DENSITY	**2.71882*****	**16.39220*****	**2.71882*****
cons	26.48444***	49.61814	26.48444***
No. of Obs.	280	280	280

Notes: $MIGRATION_j$ is net migration rate by country (per 1,000 population); TEM_i is average temperature by country (^0C); RAI_i is logarithm of rainfall by country (mm); CO_{2i} is logarithm of the CO_2 emissions ($MtCO_2$); ROL_i is the rules of laws (points); $UEMMPL_i$ is the unemployment, total (% of the total labour force); $GROW_i$ is Economics growth (percent); $DENSITY_i$ is logarithm of the population density (people);

In Table 1, the results show that the TEM variable shows statistical significance and has a positive impact on the international migration in the Asian countries. With an average increase in the international migration of 0.337 per mille when the temperature increases 1^0C. Similarly, the RAI and UNEMPL variables show statistical significances and have the negative impacts on the migration. Our results indicate that the temperature is associated with increased net migration. Similar results are documented in previous studies (Backhaus et al., 2015; Thiede et al., 2016; Beine & Parsons, 2017; Dallmann & Millock, 2017; Jha et al., 2017; Mastrorillo et al., 2016; Nawrotzki & Bakhtsiyarava, 2017; Sedova & Kalkuhl, 2020; Sloat et al., 2020). However, the RAI variable shows statistical significance and has a negative impact on the net inward migration. Conversely, a 1% increase in rainfall decreases the migration to 6.413 per mille. The result also aligns with previous studies (Falco et al., 2018; Mastrorillo et al., 2016; Mueller et al., 2020; Nawrotzki & Bakhtsiyarava, 2017). Similarly, when unemployment increases by 1%, migration decreases by 0.46 per mille. Rule of law implies that virtually all scores lie between – 2.5 and 2.5, with higher scores corresponding to better outcomes. The results show that the rule of law have the positive effect to the migration. This explains that policy and the role of law have a positive impact on net inward migration flows in Asian countries. In addition, this empirical result shows that the economic growth and population density is associated with increased migration. The results further support the theories of migration (Harris & Todaro, 1970; Lee, 1966; Ravenstein, 1885).

3.3. Results of the factors affecting migration in long run

Using the panel unit root test results with Levin-Lin-Chu unit-root test, this research rejects the unit root null hypothesis at the first differences. Results from the test indicate that non-stationarity is likely. The study considers that the long-run relationship between climate change and migration may exist when they are co-integrated. The results from the Kao panel co-integration test also reject the null hypothesis, indicating that all data panels are co-integrated. As such, the fully modified OLS (FMOLS), the dynamic OLS (DOLS) and the canonical co-integration regression (CCR) are appropriate. The empirical results are shown in Table 2. Research uses the Schwarz criterion to determine optimal lag and lead. The long-term technique is estimated in this analysis by utilizing FMOLS, DOLS, and CCR estimators with the optimal lag which is 1.

With long-term FMOLS, DOLS and CCR techniques, the results show that temperature, the role of government, and population distribution have positive impacts on net inward migration for Asian countries. Specifically, with the CCR co-integration technique, research shows that a 1 Degree Celsius increase in temperature increases migration by 0.36 parts per thousand. Meanwhile, rainfall and unemployment have long-term negative impacts on international migration in these countries. Specifically, a 1% increase in rainfall reduces net inward migration by 6.19 per thousand.

In addition, the percentage points of the Role of Law increase by 1 per cent, net migration increases by 4.97 per thousand. With the same impact, for every 1 per cent increase in population concentration through the population density variable, net migration to Asian countries will increase by 1.75 per thousand.

And a 1 per cent increase in unemployment reduces net in-migration to 0.69 per thousand in the long run. The results show that migration has a very large response to unemployment.

Table 2: The long-run effects of the factors on the migration using
FOLS, DOLS and CCR estimations for Asian countries

	FMOLS MIGRATION	DOLS MIGRATION	CCR MIGRATION
TEM	**0.362****	0.373	**0.361****
RAI	**-6.194*****	-6.358	**-6.193*****
CO2	-0.747	-0.886	-0.751
ROL	**4.986*****	5.419	**4.970*****
UNEMPL	**-0.640****	-0.672	**-0.653****
GROW	0.00421	0.170	-0.00781
DENSITY	**1.749****	1.550	**1.754****
No Obs	281	279	281

Notes: $MIGRATION_j$ is net migration rate by country (per 1,000 population); TEM_i is an average temperature by country (^0C); RAI_i is logarithm of rainfall by country (mm); CO_{2i} is logarithm of the CO_2 emissions ($MtCO_2$); ROL_i is the rules of law (points); $UEMMPL_i$ is the unemployment, total (% of the total labour force); $GROW_i$ is Economics growth (percent); $DENSITY_i$ is logarithm of the population density (people).

4. Conclusion

This paper provides novel insights into the driving forces behind cross-border migration to Asian countries. While existing literature often correlates current migration flows or stocks with data on the climatic, socio-economic, political, and demographic factors, this paper utilizes five-year interval data on net migration rates in Asian countries due to the limitations of the United Nations's data.

The findings of this study have significant policy implications. In the short run, factors such as temperature, rule of law, economic growth, and population density positively influence net migration to countries. Conversely, rainfall negatively impacts net migration in Asian countries. Long-term results reinforce these short-term findings, showing that some factors not only affect migration in the short term but also exhibit delayed effects over several years. Specifically, unemployment continues to have a similar impact as reported by other studies, leading to reduced net migration due to concerns about job scarcity in the host country. The study highlights several important policy implications.

Firstly, the research suggests that climate change is a significant driver of international migration in Asian countries. The results indicate that rising temperatures, global warming, and shifts in precipitation patterns profoundly affect living and working conditions in these nations. Specifically, temperature has a significant positive effect on net migration (Beine & Parsons, 2019; Sloat et al., 2020; Cattaneo et al., 2019). Environmental and climate concerns are increasingly crucial and exert substantial influence over global population movements, particularly in Asia. To address this, one effective strategy is to enhance environmental quality to attract migrants from other countries and deter emigration from origin countries. Conversely, rainfall has long-term negative impacts on international migration (Suckall et al., 2017; Cattaneo et al., 2019). Many Asian countries, such as Thailand, Vietnam, Laos, Cambodia, India, and the Philippines, are heavily dependent on agriculture and thus sensitive to climatic factors affecting agricultural production. Consequently, rainfall continues to impact the migration behavior of people in these countries.

Secondly, the rule of law positively affects net migration (McConnon, 2020; Hasnat et al., 2022; Withers et al., 2022). Population density also has a positive impact on net migration (Blachaus et al., 2015; Rafiq et al., 2017; Guzi & Mikula, 2022). Both the rule of law and population distribution positively influence net inward migration in Asian countries (Adedoyin et al., 2020; Long et al., 2022). These findings support the notion of a strong positive relationship between policy and demographic factors and international migration trends.

Thirdly, unemployment negatively impacts net migration (Latif, 2015; Guzi & Mikula, 2022). Unemployment is a significant factor that reduces net migration flows to a country, as migrant workers may leave to seek job opportunities elsewhere and earn better income.

Finally, economic incentives play a pivotal role in promoting in-migration, while socioeconomic disadvantages tend to restrict immigration and encourage emigration. Empirical evidence underscores that climate change, environmental degradation, government policies, economic factors, and population density are key factors shaping international migration patterns in Asian countries.

References

AboElsoud, M. E., AlQudah, A., & Elish, E. (2020). Does a change in immigration affect the unemployment rate in host countries? Evidence from Australia. *Journal of Applied Economics, 23*(1), 21-43. https://doi.org/10.1080/15140326.2019.1684740

Achtnich, M. (2022). Waiting to move on: Migration, borderwork and mobility economies in Libya. *Geopolitics, 27*(5), 1376-1389. https://doi.org/10.1080/14650045.2021.1919626

Agba, A. O., Akpanudoedehe, J. J., Ojong, F. E., & Agba, M. S. (2021). Climate change, adaptation, and global jobs: Lessons and urgent policy options for Africa. *Quantitative Economics and Management Studies, 2*(3), 163-181. https://doi.org/10.35877/454ri.qems298

Arisman, A., & Jaya, R. K. (2020). Labour migration in ASEAN: Indonesian migrant workers in Johor Bahru, Malaysia. *Asian Education and Development Studies, 10*(1), 27-39. https://www.emerald.com/insight/2046-3162.htm

Backhaus, A., Martinez-Zarzoso, I., & Muris, C. (2015). Do climate variations explain bilateral migration? A gravity model analysis. *IZA Journal of Migration, 4*(1), 3. https://doi.org/10.1186/s40176-014-0026-3

Begossi, A. (1999). Caiçaras, caboclos and natural resources: Rules and scale patterns. *Ambiente & Sociedade, 5*, 55-67. https://doi.org/10.1590/S1414-753X1999000200005

Beine, M., & Parsons, C. R. (2017). Climatic factors as determinants of international migration. *CESifo Economic Studies, 63*(4), 386-402. https://doi.org/10.1093/cesifo/ifx017

Beyer, R. M., Schewe, J., & Lotze-Campen, H. (2022). Gravity models do not explain, and cannot predict, international migration dynamics. *Humanities and Social Sciences Communications, 9*(1), 1-10. https://doi.org/10.1057/s41599-022-01067-x

Black, R., Bennett, S. R. G., Beddington, J. R., & M. Thomas, S. (2011). *Migration as adaptation.* https://www.nature.com/articles/478477a

Cattaneo, C., Beine, M., Fröhlich, C. J., Kniveton, D., Martinez-Zarzoso, I., Mastrorillo, M., & Schraven, B. (2019). Human migration in the era of climate change. *Review of Environmental Economics and Policy, 13*(2), 189–206. https://doi.org/10.1093/reep/rez008

Chen, J., & Mueller, V. (2019). Climate-induced cross-border migration and change in demographic structure. *Population and Environment, 41*(2), 98-125. https://doi.org/10.1007/s11111-019-00328-3

Cottier, T., & Shingal, A. (2021). Migration, trade and investment: Towards a new common concern of humankind. *Journal of World Trade, 55*(1), 51-76. https://doi.org/10.54648/trad2021002

Curran, S., & Agardy, T. (2002). Common property systems, migration, and coastal ecosystems. *Ambio, 31*, 303-305. http://doi.org/10.1639/0044-7447(2002)031[0303:CPSMAC]2.0.CO;2

Czaika, M., & de Haas, H. (2017). The effect of visas on migration processes. *International Migration Review, 51*(4), 893-926. https://www.jstor.org/stable/45116670

Dallmann, I., & Millock, K. (2017). Climate variability and inter-state migration in India. *CESifo Economic Studies, 63*(4), 560-594. https://doi.org/10.1093/cesifo/ifx014

Espinosa, A. M., & Díaz-Emparanza, I. (2021). The long-term relationship between international labour migration and unemployment in Spain. *Journal of International Migration and Integration, 22*(1), 145-166. http://doi.org/10.1007/s12134-019-00716-6

Falco, C., Galeotti, M., & Olper, A. (2019). Climate change and migration: Is agriculture the main channel? *Global Environmental Change, 59*, 101995. https://doi.org/10.1016/j.gloenvcha.2019.101995

Feng, S., & Oppenheimer, M. (2012). Applying statistical models to the climate-migration relationship. *Proceedings of the National Academy of Sciences, 109*(43), E2915–E2915. https://doi.org/10.1073/pnas.1212226109

Gray, C., & Bilsborrow, R. (2013). Environmental influences on human migration in rural Ecuador. *Demography, 50*(4), 1217–1241. https://doi.org/10.1007/s13524-012-0192-y

Harris, J. R., & Todaro, M. P. (1970). Migration, unemployment and development: A two-sector analysis. *The American Economic Review, 60*(1), 126–142. https://www.jstor.org/stable/1807860

Hunter, R. M., Davie, C., Rudd, A., Thompson, A., Walker, H., Thomson, N., Mountford, J., Schwamm, L., Deanfield, J., Thompson, K., Dewan, B., Mistry, M., Quoraishi, S., & Morris, S. (2013). Impact on clinical and cost outcomes of a centralized approach to acute stroke care in London: A comparative effectiveness before and after model. *PloS One, 8*(8), e70420. https://doi.org/10.1371/journal.pone.0070420

Huynh, H. H, & Vo, D. H. (2023). The effects of migration on unemployment: New evidence from the Asian Countries. *Sustainability. 15*(14), 11385. https://doi.org/10.3390/su151411385

Jha, C. K., Gupta, V., Chattopadhyay, U., & Amarayil Sreeraman, B. (2017). Migration as adaptation strategy to cope with climate change: A study of farmers' migration in rural India. *International Journal of Climate Change Strategies and Management, 10*(1), 121-141. https://doi.org/10.1108/IJCCSM-03-2017-0059

Kaenzig, R., & Piguet, E. (2013). Migration and climate change in Latin America and the Caribbean. *Global Migration Issues, 155–176.* https://doi.org/10.1007/978-94-007-6985-4_7

Lee, E. S. (1966). A theory of migration. *Demography, 3*(1), 47–57. https://doi.org/10.2307/2060063

Long, H., Li, J., & Liu, H. (2022). Internal migration and associated carbon emission changes: Evidence from cities in China. *Energy Economics, 110*, 106010. https://doi.org/10.1016/j.eneco.2022.106010

Marchiori, E., & Cantoni, L. (2015). The role of prior experience in the perception of a tourism destination

in user-generated content. *Journal of Destination Marketing & Management*, *4*(3), 194–201. https://doi.org/10.1016/j.jdmm.2015.06.001

Massey, D. S., Arango, J., Hugo, G., Kouaouci, A., Pellegrino, A., & Taylor, J. E. (1993). Theories of international migration: A review and appraisal. *Population and Development Review*, *19*(3), 431–466. https://doi.org/10.2307/2938462

Mastrorillo, M., Licker, R., Bohra-Mishra, P., Fagiolo, G., D. Estes, L., & Oppenheimer, M. (2016). The influence of climate variability on internal migration flows in South Africa. *Global Environmental Change*, *39*, 155–169. https://doi.org/10.1016/j.gloenvcha.2016.04.014

Minehan, S., & Wesselbaum, D. (2023). Do climate change expectations drive migration? Evidence from migration flows towards OECD countries. *Global and Planetary Change*, *227*, 104188. https://doi.org/10.1016/j.gloplacha.2023.104188

Mueller, V., Sheriff, G., Dou, X., & Gray, C. (2020). Temporary migration and climate variation in eastern Africa. *World Development*, *126*, 104704. https://doi.org/10.1016/j.worlddev.2019.104704

Muñoz-Mora, J. C., Aparicio, S., Martinez-Moya, D., & Urbano, D. (2022). From immigrants to local entrepreneurs: Understanding the effects of migration on entrepreneurship in a highly informal country. *International Journal of Entrepreneurial Behavior & Research*, *28*(9), 78-103. https://doi.org/10.1108/IJEBR-07-2021-0615

Nawrotzki, R. J., & Bakhtsiyarava, M. (2017). International climate migration: Evidence for the climate inhibitor mechanism and the agricultural pathway. *Population, Space and Place*, *23*(4), e2033. https://doi.org/10.1002/psp.2033

Nawrotzki, R. J., Riosmena, F., & Hunter, L. M. (2013). Do rainfall deficits predict U.S.-bound migration from rural Mexico? Evidence from the Mexican Census. *Population Research and Policy Review*, *32*(1), 129–158. https://doi.org/10.1007/s11113-012-9251-8

Ravenstein, E. G. (1885). The laws of migration. *Journal of the Statistical Society of London, 48*(2), 167–235. https://doi.org/10.2307/2979181

Raymer, J., Liu, N., & Bai, X. (2019). Age articulation of Australia's international migration. In R. Franklin (Ed.), *Population, place and spatial interaction* (pp. 171–200). Springer. https://doi.org/10.1007/978-981-13-9231-3_10

Schneider, O. (2022). Labour migration in the European Union: The case of Central and Eastern Europe. *Economic Annals*, *67*(233), 7-38. http://doi.org/10.2298/EKA2233007S

Sedova, B., & Kalkuhl, M. (2020). Who are the climate migrants and where do they go? Evidence from rural India. *World Development*, *129*. https://doi.org/10.1016/j.worlddev.2019.104848

Sloat, L. L., Davis, S. J., Gerber, J. S., Moore, F. C., Ray, D. K., West, P. C., & Mueller, N. D. (2020). Climate adaptation by crop migration. *Nature Communications*, *11*(1), Article 1. https://doi.org/10.1038/s41467-020-15076-4

Thiede, B., Gray, C., & Mueller, V. (2016). Climate variability and inter-provincial migration in South America, 1970-2011. *Global Environmental Change : Human and Policy Dimensions*, *41*, 228–240. https://doi.org/10.1016/j.gloenvcha.2016.10.005

Thomas, M. J. (2019). Employment, education, and family: Revealing the motives behind internal migration in Great Britain. *Population, Space and Place, 25*(4), e2233.

Tombe, T., & Zhu, X. (2019). Trade, migration, and productivity: A quantitative analysis of China. *American Economic Review, 109*(5), 1843-1872. http://doi.org/10.1257/aer.20150811

Tomohara, A. (2019). Migrant and business network effects on intellectual property trade: Evidence from Japan. *Economic Analysis and Policy*, *62*, 131-139. https://doi.org/10.1016/j.eap.2019.01.007

United Nations. (2020). *World social report 2020: Inequality in a rapidly changing world.* United Nations. https://www.un.org/development/desa/dspd/wp-content/uploads/sites/22/2020/02/World-Social-Report2020-FullReport.pdf

Withers, M., Henderson, S., & Shivakoti, R. (2022). International migration, remittances and COVID-19: Economic implications and policy options for South Asia. *Journal of Asian Public Policy*, *15*(2), 284-299. https://doi.org/10.1080/17516234.2021.1880047

Appendix 1 - The selected ASIAN countries

Afghanistan, Armenia, Azerbaijan, Bahrain, Bangladesh, Bhutan, Brunei Darussalam, Cambodia, China, Cyprus, Georgia, India, Indonesia, Iran, Iraq, Israel, Japan, Jordan, Kazakhstan, Kuwait, Kyrgyzstan, Lao People's DR, Lebanon, Malaysia, Maldives, Mongolia, Myanmar, Nepal, DPR of Korea, Oman, Pakistan, Philippines, Qatar, Saudi Arabia, Singapore, Republic of Korea, Sri Lanka, Syrian Arab Emirates, Tajikistan, Thailand, Timor-Leste, Turkey, Turkmenistan, United Arab Emirates, Uzbekistan, Viet Nam, Yemen