Threshold effects of migration stock on economic vulnerability: Evidence from Small Island Developing States

Zhaoming Bi
Fujian University of Technology, China
Hong Chen
Fujian University of Technology, China
Nitika Nand
The University of the South Pacific, Fiji
Baljeet Singh
The University of the South Pacific, Fiji

Abstract

Economic vulnerability in small island developing states is mainly caused by weak economic structure, vulnerable natural resource structure and spillovers from external community. Economic vulnerability can be mitigated through multiple efforts, one of which in the case of small island developing states is migration stock development. Through the channel of personal remittances, migration stock helps stabilize household’s livelihood and contributes to the source of fundamental natural resource imports, and hence to some level enhances a home country’s resilience to economic vulnerability. However, migration stock’s mitigation effect on economic vulnerability may be subject to changes in macroeconomic environment such as the development of foreign investment. At a lower level of migration stock, more foreign investment is directed to strengthen economic structure and energy security, and hence provide a better environment to boost migration stock’s role in mitigating economic vulnerability. This hypothesis is tested in a threshold model where foreign direct investment is used as the regime factor, and it is found that migration stock is more effective on reducing economic vulnerability at a lower level of migration stock respect to foreign direct investment in 32 SIDS over 2002-2018.

Keywords: economic vulnerability, migration, foreign investment, threshold model, small island developing states

1. Introduction

Recently, the concept of vulnerability is receiving unprecedented attention within policy makers and development economists. Increasing extreme phenomena in the last decade such as cyclone Winston in Fiji, flood in New Zealand, heat wave in Europe and Horn of Africa drought, global financial crisis and the COVID-19 pandemic significantly demonstrate the potential vulnerability of human existence to extreme events and disturbances. The vulnerability in the current study refers to the sensitivity and exposure of key sectors of an economy to exogenous shocks and resilience refers to its ability to withstand and recover from these shocks. Reducing the vulnerability of communities and nations is critically important for economic stability and
economic resilience to exogenous shocks. Thus, it is immensely important to identify which factors contribute to and which factors impede vulnerability. This study using economic vulnerability index of Feindouno & Goujon (2016)\(^1\) formally examines the effects of migration stock on economic vulnerability (EV) in small island development states (SIDS).

Although extreme climatic events and external shocks affect both developed and developing countries, countries vary in their susceptibility to exogenous shocks, as well as their level of exposure, commitment, and response strategies. Among the countries across the globe, SIDS are particularly vulnerable to exogenous shocks due to low levels of economic and social development, unique geography and small size. SIDS incur greatest cost of adjusting to threats associated with global warming and climate change (Briguglio, 2014; Easterly and Kraay, 2000; ECLAC, 2005), with high burden of cost related to low resilience of social, physical and environment factors. SIDS are highly likely to confront a future where limited natural endowments, lack of economic opportunities and infrastructure, can potentially be exposed not only to large-scale climate disaster but also to a more permanent state of stress caused by sea level rise, long spell of droughts, more frequent and severe cyclones (Julca and Paddison, 2010, Sanders, 1997).

Increasing concentration of economic activities, physical infrastructure and greater population densities further acerbate the vulnerability of SIDS to hazards. In this perspective, labour migration (or alternatively, emigration) becomes a double-edged sword. On one hand, it can lessen vulnerability through reduced risk of social instability such as like protests and violence by reducing the demand for public services in home countries(Julca and Paddison, 2010). In addition, according to the altruism hypothesis, individual and families migrate to spread household risk and protect household against unexpected changes in income due to natural disasters and/or economic shocks. On the other hand, labour migration can make the country more vulnerable by causing the loss of highly skilled workers and affect food supply (Julca and Paddison, 2010). Studies such as Kinzig et al. (2006) and Craven (2015) argue that migration can provoke increase vulnerability in sending countries, households, and communities by creating dependence on unsecure income sources.

The link between migration and vulnerability is particularly important for SIDS for the following reasons. Migrant-remittances to SIDS have been steadily increasing, particularly in comparison to capital flows, due to the growing international labour mobility. Following the COVID-19 pandemic, migration of workers from SIDS has significantly grown. Many OECD countries are experiencing a significant increase in labor shortages, partly due to a sharp increase in demand following the pandemic and partly due to employment structural changes as many workers seek better-paying and higher-quality jobs (Causa, et al. 2022). The labor shortage in OECD countries presents a significant opportunity for employment and migration for workers and households in SIDS. Secondly, remittances have proven remarkably resilient during global crises such as the 2008 financial crisis and the current COVID-19 pandemic. In

---

\(^1\) This index, composed of shocks (scale and possibility of natural or external shocks) and exposure (structural exposure to those shocks), is a weighted average index of population, export concentration, agriculture, forestry and fisheries, natural disasters, and exports of goods and services.
many cases, remittance flows to SIDS, particularly the Pacific Island countries (PICs), have increased during these crises, providing much-needed support for these countries.

SIDS presents a special case as traditional migrants from SIDS mostly consist of skilled and highly qualified personals, hence migration stock’s impact is likely to be unique to SIDS. Despite growing significance of migration, in the form of remittances received, to SIDS in general and PICs in particularly, there is lack of studies examining the impacts of migration on economic vulnerability in SIDS. Moreover, some studies examined the issue in the context of the developing countries, but the evidence is inconclusive. This study therefore examines the impacts of migration on economic vulnerability in SIDS, and makes novel contributions to the extant literature. This is one of the first studies to examine the impact of migration on economic vulnerability, using the unique dataset on SIDS.

On the positive note migration of skilled workers has helped reduce the burden on domestic labor markets and eased the possibility of social unrest and dissatisfaction (Julca and Paddison, 2010). For example, countries like Fiji, Tonga, Samoa among other SIDS have seen a significant number of people migrating over the last thirty years, yet these economies are still unable to generate adequate employment opportunities for even a small percentage of their yearly graduates. Migration has therefore provided an alternative means of employment for these individuals, and also helped overcome vulnerability arising from poorly defined property rights. Similarly, migration of farm workers can also reduce vulnerability by releasing pressure on key natural resources such as ocean, forestry, and land. This can help sustainably manage these resources, leading to improved economic outcomes in the long term. In addition, families in migrants’ home countries can improve their social and economic status by utilizing the remittances they receive.

On the contrary, the loss of skilled workers can result in national-level vulnerability. For instance, the emigration of skilled medical professionals has led to a shortage of healthcare workers, resulting in lower quality healthcare and increased vulnerability to public health crises (Julca and Paddison, 2010, Brown and Connell, 2005). Likewise, the rapid increase in migration from SIDS may exacerbate their vulnerability to the climate change, as it can lead to the underutilization of critical infrastructure, such as coastal protection systems, and a shortage of specialized personnel, such as disaster response and recovery experts. Moreover, the recent surge in the emigration of farmers and semi-skilled workers can potentially contribute to economic disruption, higher wage inflation, food shortage, and the vulnerability by creating labor shortages in key sectors of the economy (Lazos-Chaverio and Jimenez-Moreno, 2022). The over-reliance on these transfers can create moral hazards that negatively affect households and discourage diversification of income sources. This dependence on remittances has been observed in many SIDS such as Tonga, Samoa, Cook Islands, and Niue, where it has resulted in undesirable consequences such as a decline in economic activities and deterioration of the countries’ current account balance when remittances stop flowing (Julca and Paddison, 2010).

Moreover, several studies have noted that migration and foreign direct investment (FDI) share a unique relationship which can potentially affect emigrants’ impact on economic vulnerability.
According to the linkage effects theory, emigration can contribute to greater FDI inflows, as emigration improves the relationship between countries and fosters better understanding of the socio-economic conditions and culture of countries across boarder (Wang et al., 2013; Marcha and Jayet, 2016). According to Javorcik et al. (2011) the existence of individuals and workers with similar ethic or national background on both side of the border can provide better information about potential markets and opportunities. SIDSs are among most mobile countries in the world with emigration allowing them to build vast familial networks connecting SIDs with Australia, New Zealand, North America, and Europe (Pelling and Uitto, 2001). Initially, rising emigration contributed to greater FDI inflows to SIDs (see Figure 1). However, as the emigration continued to increase FDI inflows declined due to the brain drain problem (Castellani, 2007). The emigration of workers from SIDs is increasing skewed towards high-skilled and well-educated workers. Theoretically, the loss of high skilled workers causes shortage of workers, leading to higher wages and reduces the domestic returns to capital, which can discourage FDI inflows. Moreover, the loss of skilled labour affects country’s ability to adopt technological innovations, and further discourages FDI inflows, particularly in technological intensive sectors (Kugler and Rapoport, 2007).

In the context of SIDS, we postulate that in the early stage of development, emigration plays a more significant role in reducing economic vulnerability as it provides the mechanism to cope with economic risks and improve resilience through income diversification. On the other hand, migration stock allows SIDS to avoid social unrest, as emigration reduces the demand for employment and public services and further addresses ecological exploitation problems. These create a better environment for encouraging the inflows of FDI, as implied by the linkage effects theory. However, as emigration continues to increase, the SIDS increasingly suffer from the brain drain problem which reduces their ability to respond to natural disasters. Loss of skilled workers negatively affects FDI inflows in highly skilled labour-intensive sectors and disproportionately tilt FDI towards resource-based sectors, which undermines SIDS’ resilience to economic vulnerability. Coupled with the declines in FDI, as per the linkage effects theory, emigration stock at a higher-level plays a less effective role on reducing economic vulnerability. In short, we hypothesize that the effects of migration stock on SIDS’ economic vulnerability change with its own level, and such effects are contingent on FDI. Given the above background, this study examines threshold impacts of migration stock, contingent on FDI, on economic vulnerability using the panel data of 32 small island countries over the period 2002-2018. Using the fixed-effect panel threshold model we find that migration stock overall reduces economic vulnerability in SIDS. We note that, subject to FDI, migration’s mitigation effect diminishes with the level of migration.

The rest of the paper is organised as follows. Section 2 provides the literature review, section 3 outlines the model and data, section 4 presents results and discussion, and section 5 concludes the paper.

Figure 1. Scatter diagram between migration stock (natural logarithm) and FDI ratio
Note: The utilized series show clear non-stable trends in most sample countries. And the interaction between migration stock and FDI ratio is further exhibited in a scatter diagram, which shows a quadratic relationship between the two series.

2.0 Literature Review

The issue of vulnerability is extensively researched at both macro and micro levels. Hoffman and Wallace (2018) examined the ability of households to survive exogenous shocks from a micro-perspective. At the macro-level, Wang, Han ad Ma (2022) and Nguyen and Su (2020) noted of tourism development on economic vulnerability in developing countries. Several theoretical and empirical studies also examined the impacts of migration and remittances on economic vulnerability. For instance, Howell (2017) argues migration reduces vulnerability of households and economies to exogenous shocks. In absence of migration opportunity, families could be trapped in location where food security and opportunities to make a liveable income are scarce (Bharadwaj et al., 2021 and Silchenko and Murray2023). Bouoiyour, Selmi and Miftah (2016) noted that remittance reduce economic volatility in case of Morocco. Chami et al. (2008) and Bugamelli and Paterno (2009) also noted that remittances reduce growth volatility using cross-section of 70 and 60 countries respectively.

The literature also witnesses other affecting factors of economic vulnerability. For instance, high degree of openness and dependence on the global economy can make economies crucially vulnerable to a variety of global political economic condition and external shocks particularly when there is interplay between trade exposure and external shocks (Briguglio, 2009, Jorgenson, Dick and Mahutga, 2007). These shocks can potentially suppress economic growth, provoke higher income inequality and cause uncontrolled urbanization and urban primacy, and thus heightened economic vulnerability (Kentor 2001). According to Gibson, Ostrom and Ahn (2000), multinationals maximize profit by achieving economies of scale at the expense of local ecology and ecological vulnerability increase socio-economic exposure (Siegel, Cabral, McHenry, Ojea, Owashi and Lester, 2019; Suane and Roca-Sagales, 2015). Similarly, Adams and Klobodu (2017) noted that foreign investment contributed to increased short-term and as well as long-long inequality and inequality causes economic vulnerability (Beckfield, 2006,
Rash, 2017, Ryder, 2017). Foreigners are also acquiring houses and properties in developing countries such as SIDS which have significantly increased prices of houses and created housing shortages for the locals. Moreover, studies such as UNCTADSTAT (2016) and Alvarado, Inguez and Ponce (2017) argue that concentration of FDI in primary produce can make economy more volatile as commodity prices are highly volatile over time.

3.0 The model

The linkage effects theory and brain drain hypothesis about migration stock and foreign investment set the foundation for the current empirical model. Further, implied by growth theories and the empirical literature, the analysis considers a wide range of macroeconomic indicators, including migration stock, gross national income, labor participation, investment, unemployment, personal remittances, official development assistance received, domestic credit to private sector, exports and imports, final consumption expenditure, industry value added, central government debt, and inflation. This employs the FERDI’s EV index, which is constructed by using data on population, remoteness, economic structure, merchandise export, exports of goods and services, environment, natural disasters, etc. For the current particular study, we investigate the factors contributing to mitigate economic vulnerability, and we try to avoid using factors contributing to the calculation of the EV index. Further, given limited availability of quality data and also high correlation amongst many indicators whichever available, our empirical analysis ends up with national income and migration stock as significant explanatory factors. Therefore, the following fixed-effect panel threshold model is adopted to test our proposed hypothesis that the effects of migration on economic vulnerability are contingent on FDI:

\[
\begin{align*}
    ev_{it} &= \beta_{0i} + \beta_{1}^\text{lower} \cdot mig_{it} + \beta_{2}^\text{lower} \cdot gni_{it} + u_{it}, \quad mig_{it} < \gamma \\
    ev_{it} &= \beta_{0i} + \beta_{1}^\text{upper} \cdot mig_{it} + \beta_{2}^\text{upper} \cdot gni_{it} + u_{it}, \quad mig_{it} \geq \gamma
\end{align*}
\]

The dependent variable \(ev_{it}\) is the economic vulnerability index measured out of 100. The larger the index, the more vulnerable an economy is. This index is one of the three criteria for the identification of the Least Developed Countries. Data comes from the FERDI database. The explanatory variables of interest is natural logarithmic migration stock, \(mig_{it}\), sourced from United Nations Department of Economic and Social Affairs. According to our hypothesis, \(mig_{it}\) is the proposed threshold variable and FDI to GDI ratio (\(fdi_{it}\)) is the regime variable. Further, the control variable is natural logarithmic gross national income, \(gni_{it}\). Data on FDI and GNI are sourced from World Bank’s World Development Indicators database. And \(\gamma\) is the proposed single threshold level.

3.1 Data description

The current study utilizes the data on 32 small island developing countries over the period 2002-2018, subject to the limitation of data availability. List of countries is presented in Table 1. It is noted that none of European SIDS is covered in the current sample. Economic vulnerability

---

data come from the FERDI database and the rest series come from World Development Indicators database. The trends of utilized series are described in Figures 2 to 5.

Table 1. List of sample countries

<table>
<thead>
<tr>
<th>Country</th>
<th>Country</th>
<th>Country</th>
</tr>
</thead>
<tbody>
<tr>
<td>Antigua and Barbuda</td>
<td>Grenada</td>
<td>Solomon Islands</td>
</tr>
<tr>
<td>Bahrain</td>
<td>Guyana</td>
<td>Sao Tome and Principe</td>
</tr>
<tr>
<td>Bahamas</td>
<td>Haiti</td>
<td>Suriname</td>
</tr>
<tr>
<td>Belize</td>
<td>Jamaica</td>
<td>Seychelles</td>
</tr>
<tr>
<td>Barbados</td>
<td>Kiribati</td>
<td>Tonga</td>
</tr>
<tr>
<td>Comoros</td>
<td>Saint Kitts and Nevis</td>
<td>Trinidad and Tobago</td>
</tr>
<tr>
<td>Cape Verde</td>
<td>Saint Lucia</td>
<td>Tuvalu</td>
</tr>
<tr>
<td>Dominica</td>
<td>Maldives</td>
<td>Saint Vincent and the Grenadines</td>
</tr>
<tr>
<td>Dominican Republic</td>
<td>Mauritius</td>
<td>Vanuatu</td>
</tr>
<tr>
<td>Fiji</td>
<td>Papua New Guinea</td>
<td>Samoa</td>
</tr>
<tr>
<td>SGP</td>
<td>Singapore</td>
<td></td>
</tr>
</tbody>
</table>

Figure 2. Trends of economic vulnerability index over 2002-2018

Figure 3. Trends of migration stock (natural logarithm) over 2002-2018
Figure 4. Trends of FDI inflows to GDP ratio over 2002-2018

Figure 5. Trends of real gross national income (natural logarithm) over 2002-2018
4. Empirical findings and Discussion

The empirical analysis follows the procedure of testing for unit root, cointegration and cross-sectional dependence, conducting regressions. Results are summarized in Tables 2-5.

Karavias and Tzavalis (2014) panel unit root test is used to test for the null hypothesis that all panel time series are unit root processes. The tests hypothesize cross-section dependence and cross-section heteroskedasticity in individual series, and one potential structural break. As this test requires strongly balanced panel data, number of years used in individual tests vary with series. The null hypothesis is not rejected for all series at level but rejected in their first differences, leading to the conclusion that all series are integrated of order one. Test results are reported in Table 2.

Table 2. Panel unit root tests

<table>
<thead>
<tr>
<th>Variable</th>
<th>minZ-stat</th>
<th>p-value</th>
<th>Variable</th>
<th>minZ-stat</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>$ev_{t,t}$</td>
<td>-1.4734</td>
<td>0.4700</td>
<td>$Δev_{t,t}$</td>
<td>-18.6971</td>
<td>0.0000</td>
</tr>
<tr>
<td>$mig_{t,t}$</td>
<td>-2.0168</td>
<td>0.4048</td>
<td>$Δmig_{t,t}$</td>
<td>-1.8595</td>
<td>0.0315</td>
</tr>
<tr>
<td>$gni_{t,t}$</td>
<td>-0.0002</td>
<td>0.6700</td>
<td>$Δgni_{t,t}$</td>
<td>-0.2288</td>
<td>0.0300</td>
</tr>
<tr>
<td>$fdi_{t,t}$</td>
<td>-1.1057</td>
<td>0.1344</td>
<td>$Δfdi_{t,t}$</td>
<td>-10.8365</td>
<td>0.0000</td>
</tr>
</tbody>
</table>

We employ Kao (1999), Pedroni (1999, 2004), and Westerlund (2005) tests to test for the null hypothesis of no panel cointegration. Assumptions used in the tests include panel specific cointegrating vector, panel means included, no time trend, and panel-specific AR parameter.
Most tests reject the null hypothesis. Test results are shown in Table 3.

Table 3. Panel cointegration tests

<table>
<thead>
<tr>
<th>Test</th>
<th>stat</th>
<th>p-value</th>
<th>Test</th>
<th>stat</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dickey-Fuller t</td>
<td>-1.6766</td>
<td>0.0468</td>
<td>Modified Phillips–Perron t</td>
<td>3.8960</td>
<td>0.0000</td>
</tr>
<tr>
<td>Modified D-F t</td>
<td>-0.3330</td>
<td>0.3696</td>
<td>Phillips–Perron t</td>
<td>-2.0077</td>
<td>0.0223</td>
</tr>
<tr>
<td>Augmented D-F t</td>
<td>-1.3131</td>
<td>0.0946</td>
<td>Augmented D-F t</td>
<td>-1.4040</td>
<td>0.0802</td>
</tr>
<tr>
<td>Unadjusted modified D-F t</td>
<td>-0.4814</td>
<td>0.3151</td>
<td>Westerlund (2005) test</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unadjusted D-F t</td>
<td>-1.7744</td>
<td>0.0380</td>
<td>Variance ratio</td>
<td>1.9264</td>
<td>0.0270</td>
</tr>
</tbody>
</table>

We adopt Frees (1995, 2004), Friedman (1937) and Pesaran (2004) tests to test the hypothesis of cross-sectional independence in panel-data models with small T and large N by implementing two semiparametric tests proposed by Friedman (1937) and Frees (1995, 2004), as well as the parametric testing procedure proposed by Pesaran (2004). And two of the three tests do not reject the null hypothesis that error terms of the model are independent across cross sections.

Table 4. Cross-sectional independence

<table>
<thead>
<tr>
<th>Test</th>
<th>stat</th>
<th>5% critical value</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frees (1995)</td>
<td>5.030</td>
<td>0.1996</td>
<td></td>
</tr>
<tr>
<td>Friedman (1937)</td>
<td>19.635</td>
<td>0.9433</td>
<td></td>
</tr>
<tr>
<td>Pesaran (2004)</td>
<td>0.168</td>
<td>0.8665</td>
<td></td>
</tr>
</tbody>
</table>

To assess migration stock’s complex effects on economic vulnerability in SIDS, the fixed-effect panel threshold model is estimated using the threshold estimator. Robustness analysis is further conducted by using sub-samples. Given insufficient number of countries in most continents, sub-samples are different combinations of continents. Regression results are summarized in Table 5.

It should be noted that findings are consistent to a large degree across different regressions. According to Columns (1)-(5), GNI plays a significant role, both statistically and quantitatively, in reducing economic vulnerability in the sample SIDS. According to the full sample regression in Column (1), given other conditions unchanged, a one percent increase in real GNI is associated with a reduction of 5.24 units in the EV index. Migration stock’s effects are found
negative across all regressions, which are significant in most regressions.

Furthermore, there is strong statistical evidence that, under the influence of FDI inflows, migration stock has threshold effects on reducing economic vulnerability. On average, a larger magnitude of migration stock is found when natural logarithmic migration stock is below an estimated threshold level, for instance, 7.82 in the full sample regression in Column (1), equivalent to migration stock of around 2440 emigrants. Such effect is highly statistically significant in all regressions. Together with the threshold estimation using FDI as the regime variable, this suggests that at the lower level of migration stock, emigration of workers allows SIDS to build network which improves the coping mechanism and resilience to economic vulnerability, and hence migration stock is more significant in stabilizing household livelihood and contributes more to mitigate economic vulnerability. Moreover, the presence of SIDS nationals in developed countries provides valuable information to firms in developed countries on potential investment marketing opportunities in SIDS. Thus, emigration further contributes to reducing economic vulnerability in SIDS by facilitating greater inflows of FDI. For migration stock higher than the estimated threshold level, the magnitude of migration stock’s effect is smaller but remains statistically significant in SIDS of most continents. This suggests that at a higher level of migration stock, migration hinders inflows of FDI due to brain drain. Emigration from SIDS is skewed toward high-skilled workers which is a major contributor of skill shortage and high wages in SIDS. The wage-productivity gap is very high in SIDSs which is a major deterrent to FDI inflows. The increasing level of brain drain and its subsequent effect on FDI diminishes the ability of migration in reducing economic vulnerability.

Table 5. Regressions of economic vulnerability $\varepsilon v_{i,t}$

<table>
<thead>
<tr>
<th>Variables</th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
<th>(4)</th>
<th>(5)</th>
</tr>
</thead>
<tbody>
<tr>
<td>$gni_{i,t}$</td>
<td>-5.24***</td>
<td>-3.68***</td>
<td>-7.24***</td>
<td>-4.82***</td>
<td>-3.93***</td>
</tr>
<tr>
<td></td>
<td>(-4.76)</td>
<td>(-2.98)</td>
<td>(-5.14)</td>
<td>(-4.76)</td>
<td>(-2.81)</td>
</tr>
<tr>
<td>$mig_{i,t}$</td>
<td>-3.38*</td>
<td>-3.94**</td>
<td>-4.15</td>
<td>-3.40**</td>
<td>-2.69</td>
</tr>
<tr>
<td></td>
<td>(-1.93)</td>
<td>(-2.09)</td>
<td>(-1.54)</td>
<td>(-2.16)</td>
<td>(-1.30)</td>
</tr>
<tr>
<td><em>cat#c.fdi$</em>{i,t}$</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>-1.89***</td>
<td>-2.26***</td>
<td>-3.25***</td>
<td>-1.79***</td>
<td>-2.02***</td>
</tr>
<tr>
<td></td>
<td>(-4.28)</td>
<td>(-4.44)</td>
<td>(-5.00)</td>
<td>(-4.53)</td>
<td>(-4.18)</td>
</tr>
<tr>
<td>1</td>
<td>-.07***</td>
<td>-.11***</td>
<td>-.05</td>
<td>-.04**</td>
<td>-.07***</td>
</tr>
<tr>
<td></td>
<td>(-2.68)</td>
<td>(-3.00)</td>
<td>(-1.49)</td>
<td>(-1.85)</td>
<td>(-2.53)</td>
</tr>
<tr>
<td>constant</td>
<td>194.7***</td>
<td>168.1***</td>
<td>247.0***</td>
<td>184.2***</td>
<td>158.1***</td>
</tr>
<tr>
<td></td>
<td>(12.03)</td>
<td>(8.54)</td>
<td>(12.92)</td>
<td>(12.35)</td>
<td>(8.25)</td>
</tr>
<tr>
<td>$\gamma$</td>
<td>7.8153</td>
<td>7.7017</td>
<td>7.6073</td>
<td>7.9133</td>
<td>7.7017</td>
</tr>
<tr>
<td>Sigma_u</td>
<td>9.7940</td>
<td>9.8882</td>
<td>13.2074</td>
<td>8.0262</td>
<td>8.8894</td>
</tr>
<tr>
<td>Sigma_e</td>
<td>2.9056</td>
<td>3.0262</td>
<td>3.0133</td>
<td>2.6006</td>
<td>2.8710</td>
</tr>
<tr>
<td>rho</td>
<td>.9191</td>
<td>.9143</td>
<td>.9505</td>
<td>.9049</td>
<td>.9055</td>
</tr>
<tr>
<td></td>
<td>32</td>
<td>26</td>
<td>19</td>
<td>30</td>
<td>24</td>
</tr>
</tbody>
</table>

# countries
Our findings suggest migration can provide opportunities for nationals in SIDS to reduce their economic vulnerability. Households that send migrants are able to diversify and generate new source of income, insurance and savings. Migrant remittances are emerging as the most important foreign exchange earner for many of the SIDS. Thus, migration reduces vulnerability of households and economies to exogenous shocks (Howell, 2017). In the absence of migration opportunity, families could have been trapped in locations where food security and opportunities to make a liveable income are scarce (Bharadwaj et al., 2021; Silchenko and Murray; 2023). The findings are similar to Bouoiyour, Selmi and Miftah (2016), Chami et al. (2008) and Bugamelli and Paterno (2009) who noted economic vulnerability reducing effects of migration. However, our study is the first study that provides evidence on threshold effects of migration on economic vulnerability.

5. Conclusion

This study aims to examine the effects of migrant from SIDS on economic vulnerability of SIDS. Our findings show that migration significantly mitigates economic vulnerability in SIDS, and such mitigation effect diminishes with the development of migration stock. Our findings imply that worker migration can lessen the effects of internal exogenous shocks, for instance, sea level rise, and external ones such as financial crises and sudden short-term disturbances. During the COVID-19 crisis we show significant increases in remittances flows to most of the SIDS. Our finding that migration stock’s effect on economic vulnerability is contingent on FDI also implies that SIDS do not have the technological absorption capacity, respect to human capital, which limits investment returns for foreign firms and restrains productive linkages with small and medium firms. The findings have several policy implications.

Firstly, we suggest that SIDS should continue to increase investment in human capital, which is likely to mitigate any negative effects of migration and labor shortages. Secondly, the governments should redirect FDI from less skill-intensive sectors to high value-added sectors such manufacturing, ICT and food processing by improving absorptive capacity such as skills development. The governments should also direct foreign investment to more sustainable projects such eco-tourism and projects that can provide more inclusive development of the society.
Reference


Friedman, M. 1937. The use of ranks to avoid the assumption of normality implicit in the


Lazos-Chavero, E., Jimenez-Moreno, M., (2022) Vulnerabilidades rurales a partir del envejecimiento entre nahuas del sur de Veracruz, Revista Trace 81, 132-161.


Wang, Y., Han, L. and Ma (2022) International tourism and economic vulnerability, Annals of Tourism Research, 94: 103388