Passport Index from the lens of Global Population and Human Development Index

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Abstract

This paper examines passport indices Henley Passport Index (HPI), Nomad Passport Index (NPI), Visa Index (VI) and Arton Passport Index (API) in 2023, measuring visa-free travel privileges in 199 countries. Strong correlations exist among the indices, indicating consistent rankings. Mean visa-free travel numbers are 109.35 (HPI), 109.54 (NPI), 108.98 (VI), and 111.59 (API). Regional analysis highlights Europe's highest average passport strength, followed by the Americas, Oceania, and Africa. Within Africa, southern regions enjoy the most visa-free privileges. Europe's average strength follows Northern, Western, Eastern, and Southern regions. Populous Asia and Africa have weaker passports, while less populated Europe and Oceania boast more visa-free privileges. Rescaled indices show a positive correlation with the Human Development Index (HDI). Linear and beta regression models predict the modified index using HDI. The research suggests implications for global policies surrounding passport strengths and visa-free access, providing valuable insights into international travel privileges for diplomats and academics.

Keywords: Beta regression; linear regression; migration; passport index; visa-free.

Introduction

Globalization has dissolved international boundaries and magnified the significance of passports, as the more interconnected the world becomes, the need for international travel also grows. The world has witnessed unprecedented international travel, though disrupted by COVID-19; normal services have resumed, and the volume of travel is slowly recovering to the pre-COVID era [1]. Passports are essential for individuals to move across borders, whether for education, tourism, diplomacy, medical, business, or personal reasons. Based on foreseeable economic gains, countries enter into bilateral or multilateral agreements to allow visa-free travel between their citizens. However, most of the agreements have been a one-way benefit model as reciprocity is not always the case [2]. The passport strength measured in the index is the number of countries citizens of a particular country can travel visa-free.

Different international organizations track the number of countries that other countries can travel to visa-free, mainly using data from the International Air Transport Association (IATA) and combinations of some other methodologies. As a result, countries are ranked based on their performance. Countries with many visa-free destinations are viewed as having a stronger passport, indexed as the passport index. Over the years, passport ranking has been used in travel planning and to choose destinations that align with business or leisure travels. Passport indexes can reflect a country's diplomatic standing and the strength of its international relations. Countries with a higher passport index may have stronger diplomatic ties, facilitating easier travel for their citizens.

This paper analysed data from 2023 from four such organizations that rank passports based on visa-free travel in 199 countries. The ranking is called the Passport Index (PI), and strong passports guarantee a high number of visa-free privileges, while weak passports attract only a few visa-free destinations. The four PIs considered in this paper are the Henley Passport Index (HPI), Nomad Passport Index (NPI), Visa Index (VI), and Arton Passport Index (API). The paper also links PIs to population and the Human Development Index (HDI), which is a measure of a country's overall standings in terms of social and economic dimensions.

Extant studies in this space have reported that countries with stable political and economic conditions tend to enjoy visa-free privileges [3]. The privileges might simplify travel, reduce time in travel, and reduce costs and administrative bureaucracy often linked to visa processing, explaining why citizens in countries with low passport strength pay more fees in visa processing than those with strong passports [4]. Specifically, HPI has been found to be positively correlated with the Corruption Perception Index (r = 0.768, p < 0.0005), Global Peace Index (r = 0.671, p < 0.005), and World Happiness Report (r = 0.775, p < 0.005) [5]. As a result, passport strength can be a reflection of a country's overall favourable economic climate and business environment, political stability, quality of life, well-being, relevance, and prestige in the world. This adds another layer to the free movement determined by nationality [6]. Ironically, most countries with strong passports and high protectionism ideologies restrict access to their countries for those with weak passports as a means of protecting their countries from cultural contamination, economic challenges, and security challenges that are accompanied by high immigration [7]. Yearly reports from the ranking agencies have not included disaggregated the PI into continental subregions or linked PI to population and the Human Development Index. The relationship among the four PIs has not been reported. This research attempts to bridge the gaps found in the literature.

Methodology

Data sources

The data for the Passport Index (PIs) were obtained from the following websites:

- HPI (https://www.henleyglobal.com/passport-index/ranking)
- VI (https://visaindex.com/)
- API (https://www.artoncapital.com/passport-index/)
- NPI (https://nomadcapitalist.com/nomad-passport-index/)

Population data were obtained from the United Nations (UN), which grouped all countries into five major continental regions (CR) and sub-regions (https://unstats.un.org/unsd/demographic-social/products/vitstats/index.cshtml). Countries with no data on the four PIs were excluded. Similarly, the Human Development Index (HDI) data for 2021 were obtained from the UN database (https://hdr.undp.org/data-center/human-development-index#/indicies/HDI). The data for PIs, Population, and HDI were extracted and transferred to an Excel file for statistical analysis. Hence, the data contained six variables: HPI, NPI, VI, API, population, and HDI.

Statistical Analysis

Microsoft Excel was employed to calculate the various means and sums for the variables, while R software version 4.3.2 was used for Pearson correlation, linear, and beta regression analyses. Before applying the regression models, the four Passport Indexes (PIs) were rescaled to obtain a unified PI that represents the PIs with varying weights. The rescaling was done using the formula:

$$Y = \frac{X - \min}{\max - \min} \tag{1}$$

Where Y is the individual rescaled PI, min and max are the minimum and maximum values of each PI.

Results

Mean Passport Index

The mean of the four Passport Indexes (PIs) was computed using data from 199 countries. The mean values were disaggregated based on continental regions (CR) and sub-regions, and the results are presented in **Table 1**. These results were then linked with the population of each sub-region, computed by summing the populations of all countries within each sub-region.

From **Table 1**, it could be seen that on average, African countries have the weakest passport strength. The mean values across the four indices (HPI: 61.89, NPI: 69.57, VI: 61.35, API: 70.37) suggest a weak level of visa-free travel privileges. Comparatively, the PI for Africa is 40% lower than the global average of 109.35, 109.54, 108.98, and 111.59 for HPI, NPI, VI, and API respectively. Put differently, African Countries, on average, can only access 66 countries without a prior visa against a global access average of 110 countries. Within the subregion of Africa, Southern African countries have relatively strong passports, with higher mean values across all indices compared to other African subregions (HPI: 84.00, NPI: 87.00, VI: 84.40, API: 89.00) compared to the Western African countries who exhibit a relatively low passport strength (HPI:56.88; NPI:65.81; VI:56.25; API:66.06). More precisely, on average, Southern African countries can access 25 more countries than their Western countries counterparts.

The Americas, on average, have strong passport indices. The mean values are high across all four indices (HPI: 132.34, NPI: 129.46, VI: 132.77, API: 130.86), indicating high visa-free travel privileges. This implies that, on average, Americans can access 131 countries without a prior visa higher than the global access average of 110 countries. Within America, Central American countries demonstrate high passport strengths, with mean values indicating robust visa-free travel access (HPI: 135.88, NPI: 129.63, VI: 135.63, API: 131.63). Northern American countries, particularly the United States and Canada, have exceptionally strong passports, with very high mean values across all indices (HPI: 186.00, NPI: 172.50, VI: 189.00, API: 173.50).

Asia, on average, has moderate passport strength. The mean values across the four indices (HPI: 87.12, NPI: 91.47, VI: 85.59, API: 94.41) indicate a balanced level of visa-free travel privileges which are slightly above Africa and below the global passport access index. With these mean scores across the passport indices, Asia has a passport index lower than the global average by 18%.

Within Asia, Eastern Asian countries, including economic powerhouses like China and Japan, have strong passports with high mean values. Southern Asian countries, on average, have weaker passports, as reflected by lower mean values across all indices.

Europe, on average, has very strong passport indices. The mean values are high across all four indices (HPI: 169.11, NPI: 158.44, VI: 169.56, API: 161.76), indicating extensive visa-free travel privileges. Across the five (5) continents, Europe has the highest level of visa-free travel privileges (165 on average). The mean score of Europe is 150% and 50% higher than Africa and the global average scores. Within Europe, Northern European countries, including Nordic nations, possess exceptionally strong passports with very high mean values (HPI: 186.90, NPI: 172.20, VI: 187.30, API: 174.60). Southern European countries, while still strong, have slightly lower mean values compared to Northern Europe.

Oceania, on average, has strong passport indices. The mean values are relatively high across all four indices (HPI: 123.79, NPI: 122.57, VI: 123.79, API: 123.7), indicating good visa-free travel access. The continent has a mean score higher than the global score by 12%. Within Oceania, Australia and New Zealand, in particular, have exceptionally strong passports with very high mean values.

Table 1: The mean PI of the Four PIs and their corresponding populations across the five CRs

CR	N	HPI	NPI	VI	API	Population
Africa	**54**	**61.89**	**69.57**	**61.35**	**70.37**	**1458571421**
Eastern	18	68.00	72.89	67.33	74.17	483749137
Middle	9	51.67	62.78	51.44	62.89	202105153
Northern	6	53.83	65.33	52.67	66.17	263618741
Southern	5	84.00	87.00	84.40	89.00	69235160
Western	16	56.88	65.81	56.25	66.06	439863230
Americas	**35**	**132.34**	**129.46**	**132.77**	**130.86**	**1038757165**
Caribbean	13	125.38	122.54	125.54	123.92	39932514
Central	8	135.88	129.63	135.63	131.63	180643730
Northern	2	186.00	172.50	189.00	173.50	378777856
South	12	128.58	129.67	129.33	130.75	439403065
Asia	**51**	**87.12**	**91.47**	**85.59**	**94.41**	**4753082503**
Central	5	61.80	75.20	60.40	74.40	78165569
Eastern	8	127.75	123.38	127.75	126.25	1662476939
South-eastern	11	96.82	100.55	96.00	101.91	686824690
Southern	9	46.89	58.78	46.00	60.44	2027581642
Western	18	90.28	92.61	87.28	98.22	298033663
Europe	**45**	**169.11**	**158.44**	**169.56**	**161.76**	**741374411**
Eastern	10	156.50	151.00	155.80	153.20	287624253
Northern	10	186.90	172.20	187.30	174.60	106583220

Southern	16	156.06	146.69	156.50	151.19	151325001
Western	9	186.56	172.33	188.33	175.78	195841937
Oceania	**14**	**123.79**	**122.57**	**123.79**	**123.71**	**44674873**
Australia and New Zealand	2	186	172	188	173	31667212
Melanesia	4	100.75	102.50	99.75	103.75	12341238
Micronesia	5	113.8	116.2	115	117.2	321573
Polynesia	3	129.33	126.67	127.67	128	344850
World	**199**	**109.35**	**109.54**	**108.98**	**111.59**	**8036460373**

Mean Passport Index of Continental Regions Removed

The mean PI were computed where one of the five continental regions is removed. The rationale is to ascertain the effect of PI excluding each of the PIs of some CRs. The result is presented in **Table 2**.

Table 2: Mean obtained by removing each of the CR

CR removed	N	HPI	NPI	VI	API
Africa	145	127.02	124.43	126.72	126.94
Americas	164	104.44	105.29	103.91	107.48
Asia	148	117.01	115.77	117.05	117.51
Europe	154	91.88	95.25	91.29	96.93
Oceania	185	108.25	108.56	107.86	110.67

From **Table 2**, the exclusion of African countries results in an increase in mean PI values across all four PIs. This suggests that African countries contribute to lowering the overall mean and have weaker passport strengths. However, when the Americas are removed, the mean PI values decrease. This indicates that the Americas, on average, contribute to higher overall mean PI values. Equally, the exclusion of Asian countries results in a slight decrease in mean PI values. This suggests that, on average, Asian countries contribute to higher overall mean PI values. The presence of Asian countries enhances the passport strengths across all four indices. Additionally, without Europe, the mean PI values decrease across all indices. This indicates that Europe, on average, has a substantial impact on raising the overall mean PI, and contributes to higher passport strengths. Furthermore, the absence of Oceania leads to a decrease in mean PI values. This implies that Oceania, on average, contributes to higher overall mean PI values, and enhances passport strengths across all four indices.

Correlation among the Passport Indexes

Pearson correlation as shown in **Table 3**, revealed a significant strong positive correlation between each pairs of the PIs.

Table 3: Correlation Summary of the indexes

Pearson correlation	HPI	NPI	VI
NPI	0.990*		
VI	0.999*	0.992*	

| API | 0.996* | 0.993* | 0.996* |

*p value less than 0.001; **p value less than 0.05

Rescaling of the four Passport Indexes

The aim of the rescaling is to reduce the four PIs to values between 0 and 1 and multiply to obtain a rescaled PI. Applying equation (1) to HPI, NPI, VI and API yields;

$$= \frac{X_{HPI} - 27}{195 - 27} = \frac{X_{HPI} - 27}{168} \tag{2}$$

Where the minimum and maximum are 27 and 195 respectively (HPI}.

$$= \frac{X_{NPI} - 39}{181 - 39} = \frac{X_{NPI} - 39}{142} \tag{3}$$

Where the minimum and maximum are 39 and 181 respectively (NPI}.

$$= \frac{X_{VI} - 26}{195 - 26} = \frac{X_{VI} - 26}{169} \tag{4}$$

Where the minimum and maximum are 26 and 195 respectively (VI}.

$$= \frac{X_{API} - 40}{180 - 40} = \frac{X_{API} - 40}{140} \tag{5}$$

Where the minimum and maximum are 40 and 180 respectively (API}.
Multiplying equations (2) to (5) to obtain the rescaled PI (RPI);

$$\left(\frac{X_{HPI} - 27}{168} \right) \left(\frac{X_{NPI} - 39}{142} \right) \left(\frac{X_{VI} - 26}{169} \right) \left(\frac{X_{API} - 40}{140} \right) \tag{6}$$

$$= \frac{(X_{HPI} - 27)(X_{NPI} - 39)(X_{VI} - 26)(X_{API} - 40)}{564432960} \tag{7}$$

Where $0 \leq RPI \leq 1$.

Countries with high PIs have RPI closer to one and those with low PIs have their RPI values close to zero.

Regression Models

The Rescaled Passport Index (RPI) was predicted using the Human Development Index (HDI) data from 2021. Beta regression was employed because RPI values lie between zero and one **[8]**, while linear regression was used because RPI falls within a certain range. The results from the regression models demonstrated that the RPI is intrinsically linked with HDI. The regression models are statistically significant, and a positive increase in HDI leads to a positive increase in the RPI. Model evaluation, as seen in **Table 4**, indicates that the regression models performed optimally.

Table 4: Summary of the Regression Models

Statistic	Linear	Beta
R^2	0.575	0.599
F	266.317*	
constant	-0.915	-7.400

HDI	1.609*	8.197*
Phi coefficient		2.410*

*p value less than 0.001

The linear model from the linear regression is represented by **equation (8)**, while the beta model is expressed by **equation (9)**.

$$RPI = -0.915 + (1.609)HDI \tag{8}$$
$$RPI = -7.40 + (8.197)HDI \tag{9}$$

Conclusion

The following can be concluded from this research.

1. African countries have the weakest passport strengths, and Europe has the strongest.
2. Comparatively, the passport index for Africa is 40% lower than the global average.
3. African countries, on average, can only access 66 countries without a prior visa, against a global access average of 110 countries.
4. Within the subregion of Africa, Southern African countries have relatively strong passports, while the middle (central) Africa has the weakest.
5. Globally, passport strength is highest in Europe, followed by the Americas, then Oceania, Asia, and Africa.
6. On the other hand, the population is highest in Asia, followed by Africa, the Americas, Europe, and Oceania. Hence, the most populous continental regions (Asia and Africa) have weaker passport strengths compared with the other three (Europe, Americas, and Oceania).
7. Southern Asia has the least average Passport Index (PI). Some of the countries are Pakistan, India, Afghanistan, and Bangladesh. The region has a population of over 2 billion.
8. Northern Europe has the highest mean PI. Some of the countries are Denmark, Finland, the United Kingdom, and Norway.
9. The exclusion of African countries results in an increase in mean PI values across the world, while the removal of Europe will significantly decrease the mean PI globally.
10. The four PIs are strongly positively correlated.
11. A positive increase in HDI can lead to a positive increase in the Passport Index. This was the outcome of linear and beta regressions.
12. Countries that aspire to have a strong passport must work on improving the quality of life, well-being, and the standard of living of their citizens.

Conflict of interest Declaration

None exists among the authors.

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