Human Capital: "Travel Broadens the Mind"

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Abstract

This paper explores the effect of international travel on human capital development using a panel dataset for 64 countries over the period 1995-2019. We build a simple, static theoretical model based on consumer theory to establish relationship between interested variables, and then proceed to empirical analysis using a fixed-effect instrumental variable estimator and a system of equations as our main estimation strategies. The results indicate that international travel (tourism openness) and human capital positively reinforce each other. This finding supports global human mobility, including migration, international educational exchange and tourism, which play a crucial role in developing and spreading knowledge, culture, and technology.

Keywords: travel; human capital development; economic growth and development
JEL Classification: C23; J24; O40

1 Introduction

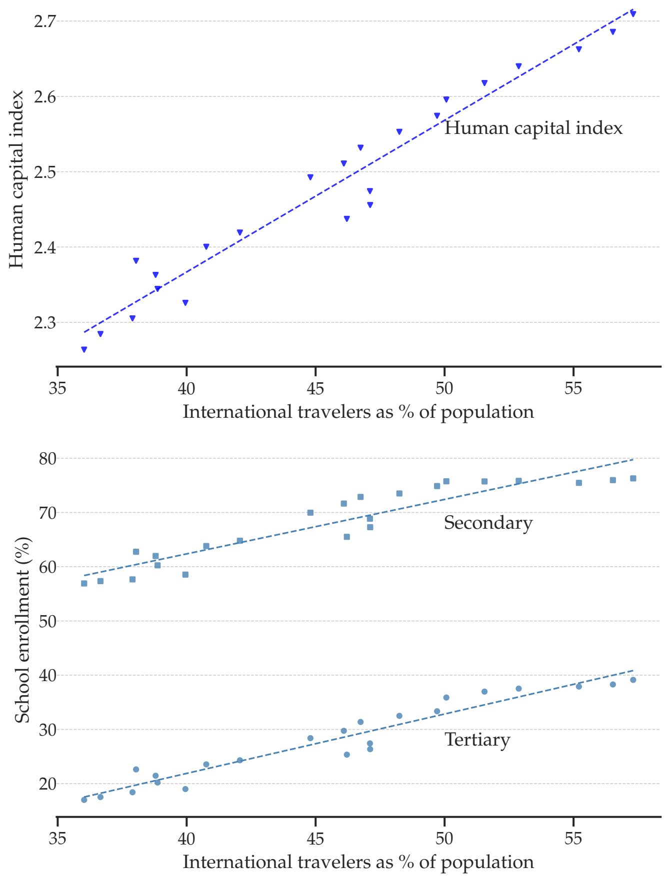
Human capital, one of the core concepts in labor economics, generally refers to the stock of skills, knowledge, experience, and attributes that individuals possess. Unlike physical capital that can be bought and sold in the market place, separated from its owner, and subject to depreciation, human capital, on the other hand, is embodied and acquired by individuals over the period of their lives, and it can be sharpened even more with its frequent use. Among all forms of capital including factories, machinery, and financial assets, the human one is the most significant contribution to the modern economy, mainly because of its role in expanding scientific and technical knowledge that improves the productivity of labor and other inputs in the production, as evidenced in the growth theories (see e.g., Barro and Sala-i-Martin 1995; Galor 2011; Lucas 1988; and Romer 1990).

Given its crucial roles, a considerable amount of research has been done to understand what enhances human capital. Early and recent prominent researchers such as Becker (2009), Goldin (2024), and Mincer (1958) highlight education, on-the-job training, and health as the most important factors. Acemoglu and Auto (2011) also identify innate ability, school quality and non-schooling investment, and pre-market conditions (e.g., peer group effects) as additional determinants. Another strand of research has examined human capital at the micro-level, considering it a multidimensional object that encompasses various components such as social emotional skills, cognition, and nutritional status, all of which can interact and begin developing from a very young age or even before birth (Attanasio, 2020). For instance, Lu, Black and Richter (2016) provide evidence to show the link between child development and socioeconomic factors such as poverty and poor nutrition[1].

In this paper, we look at it from a macro-perspective and explore the effect of human movement across borders, specifically international travel, on human capital development. As an old saying goes, "Travel broadens the mind." When people travel to new countries, they bring with them their experiences, knowledge, cultures, etc., to share with host countries; and at the same time, they can also learn new diverse ideas from the host. This exchange can help spark innovation and creativity (Hu and Wan, 2024), which in turn can help improve economic development (Lee and Chang, 2008; and Paramati, Alam, and Chen, 2017). Therefore, it should not be surprising that international inbound and outbound visitors and human capital development are positively correlated, as shown in Figure 1.

[1] Also, see Almond, Edlund and Palme (2009), and Hamadani *et al*. (2014).

Figure 1: Relationship between human capital and international travelers.



Note: The data in both panels are time series from 1995 to 2019. Human capital index is the average of 184 countries' human capital index each year, sourced from the Penn World Table version 10.01. International travelers as % of population is the world's sum of international inbound and outbound visitors divided by the world's population. School enrollment rates are the world's school enrollment rates. The source of these variables is the World Development Indicators.

Since the start of the new era of globalization in trade and migration after the fall of the Soviet Union in the 1980s, people's traveling abroad has surged and contributed significantly to the world's economy. In the early 1990s, the percentage of the world population moving across borders was just around 35%. By 2020, this figure rose to 58%, as seen in Figure 1. During the same period, human capital as estimated by the human capital index and school enrollment rates almost doubled as well.

Numerous studies have investigated the effects of international travel on economic development (e.g., AdedoyinErum and Bekunm 2022 and Chou, 2013); on trade openness (e.g., Fernandes, Pacheco and Fernandes, 2019 and Wong and Tang, 2010); on environmental pollution (e.g, Zhang *et al.*, 2020); and on creativity (Hu and Wan, 2024), to which our work relates and also differs both theoretically and empirically.

We build a theoretical framework based on consumer theory by considering overseas travel not just mere consumption—as suggested by conventional wisdom—but also investment in human capital: Traveling overseas costs people their resources but provides them with some new experiences and possibly mental health improvement. This treatment is similar to what Schultz (1961) documents in his work on investment in human capital that individuals' migration is one of the major activities that develop human capabilities. Our theory shows that international travel and human capital interact positively. We then proceed to conduct empirical analysis by using a panel dataset of 64 countries over the period 1995–2019. In particular, as a benchmark analysis, we use a pooled ordinary least squared (OLS) and fixed effects (FE) model. To deal with the issue of endogeneity, we employ instrumental variable (IV) and a system of equations as our main empirical strategy.

In particular, we first use the average cost of international travel as an instrument to obtain consistent estimates of the parameters of the production function of human capital formation. Afterwards, we use a three-stage least square estimation to run a system of two equations as human capital and overseas travel are simultaneously determined. The results show that an increase in international inbound and outbound visitors is significantly associated with an increase in human capital, and vise versa. These results are robust across different measurements of human capital. Our finding lends its support to policies that promote international school exchange programs and tourism.

The paper proceeds as follows. Section 2 establishes a static model that relates human capital to international travel. Section 3 provides specifications of econometric model and also describes data used in the empirical analysis. Section 4 discusses the results and conducts robustness checks, and section 5 concludes.

2 Relationship between Human Capital and Travel

In this section, we set up a simple, static theoretical model of human capital formation[2], which provides the theoretical framework of our empirical analysis in the next section. We establish relationship between the key interested variables: human capital and travel, and use the instrument to tackle the endogeneity issues. The work on human capital development has a rich history in economics, dating back to the sem-

[2]In this work, we simply consider a static model for two main reasons: (1) unlike other investments that take time to have impacts, international travel contemporaneously affects human capital formation, and (2) empirical results from dynamic panel data do not significantly support our model, which might be caused by shorter time series of data.

inal work by Gary Becker (Becker, 1964). In recent times, a numbers of prominent researchers have significantly advanced this framework that aids in understanding of human capital formation (e.g., Attansio *at el.*, 2020; Cunha and Heckman, 2008).

Consider an economy in which a large number of households live, and at time t, the representative produces its output, denoted Y_t, with the Cobb-Douglas technology as follows:

$$Y_t = A_t K_t^{1-\alpha} \left[h_t L_t\right]^{\alpha}, \tag{1}$$

where $\alpha \in (0.5, 1)$ is the labor share of output[3], A_t denotes productivity, K_t stands for physical capital, h_t refers to human capital, and L_t represents labor. The human capital develops based on a linear function[4] as follows:

$$h_t = \beta T_t + \beta^{\boldsymbol{H}} \boldsymbol{H}_t + e_t, \tag{2}$$

where β and $\beta^{\boldsymbol{H}}$ are constant; and $\boldsymbol{H}_t$ is a multidimensional vector of factors influence human capital, such as health, schooling and training, environments (e.g; peer group effects), all of which can be either fixed or time varying; and e_t is a random shock that encompasses all the factors indirectly unobserved in this relation. As discussed above, international travel improves human capital formation directly through learning by observing or mimicking others.

With the income Y_t, the representative household spends on consumption of goods, denoted C_t, that has a unit price of 1, and investment in international travel, denoted T_t, with a unit real price of p_t. Thus, its budget constraint is given by:

$$C_t + p_t T_t = Y_t. \tag{3}$$

Note that international travel is assumed not to be a trade-off with labor time used in production: People travel overseas during their holidays or leave. The household derives its utility from consumption of goods and travel based on its utility function:

$$U(C_t, T_t) = lnC_t + lnT_t, \tag{4}$$

where $C_t > 0$ and $T_t > 0$. The household chooses the level of consumption and investment to maximize its utility in Equation (4) subject to the constraints in Equation

[3]Historically, even though labor share falls globally, it still exceeds 50% of output, see Karabarbounis and Neiman (2014) and Kheng, Mckinley and Pan (2024).

[4]We make Equation (2) a linear function of its determinants to simplify and obtain the closed form solution to consumer's maximization problem and for empirical analysis in section 3.

(1)-(3). The maximization problem yields demand for international travel as follows:

$$T_t = \frac{Y_t}{2p_t - \alpha\beta Y_t/h_t}. \tag{5}$$

Equation (5) indicates that people are willing to travel overseas more when their income or human capital[5] increases, or when the real cost of travel decreases.

Equations (2) and (5) show that both human capital and investment in travel are determined in the model; therefore, the empirical analysis in the next section needs to account for this endogeneity issue.

3 Empirical Strategies and Data

We start with the baseline econometric model from Equation (2) that relates human capital with travel as follows:

$$h_{it} = \beta_0 + \beta_1 Travel_{it} + \beta_2 \boldsymbol{X}_{it} + \beta_3 \boldsymbol{X}_i^* + e_{it}^h, \tag{6}$$

where the subscript t denotes time, indexed $1, 2, \ldots, T$; $i = 1, 2, \ldots, N$ refers to countries; β_0, β_1, β_2 and β_3 are constant; h refer to human capital; $\boldsymbol{X}$ is a vector of control variables that vary across time and countries, including: i) schooling and training (both formal and informal), ii) health and ii) financial development; $\boldsymbol{X}^*$ is a vector of unobserved time-invariant variables such as innate ability and culture; and e_{it}^h refers to cross-country and time-variant factors that are directly unobserved in this specification.

To proxy human capital investment, we use three methods: indicator, cost, and income. The indicator method relies on school enrollment, average years of schooling or literacy; the cost method is based on education spending; and the income approach is based on expected future earnings (Abraham and Mallatt, 2022).

To measure human capital (h), we use secondary and tertiary enrollment rates, similar to Barro (1991) and Kheng, Sun and Anwar, (2017). The primary enrollment is not used because traveling across borders generally requires a certain amount of knowledge to navigate more confidently. In addition, we use human capital index constructed by Feenstra, Inklaar and Timmer (2015), who develop the index based on the average years of schooling from Barro and Lee (2013), Cohen and Soto (2007), and Cohen and

[5]The assumption $C > 0$ and $T > 0$ along with $\alpha \in (0.5, 1)$ proves that the first derivative of T with respect to h is positive in Equation (5). We provide the proof in Appendix B.

Leker (2014); and the assumed return rate to education from Psacharopoulos (1994).

To measure investment in schooling and both formal and informal training, we use government expenditure on education per capita (PPP[6]) because education has been publicly funded and provided in most places (Goldin, 2024). We also include per-capita private credit (PPP) as a measure of the financial development[7]. The more financial sector develops, easier and cheaper people can access to funding, which eases their resource constraints for schooling or training. Following Banerjee, Mishra and Maruta (2021) and Goldin (2024), We use life expectancy from birth to measure people's overall health.

For the key regressor 'Travel", we measure it by tourism openness, which is the sum of international inbound and outbound visitors as a proportion of population. As discussed earlier, we expect this key variable to positively influence human capital development, thus $\beta_1 > 0$.

As the benchmark analysis, We first estimate Equation (6) by using ordinary least square (OLS) method and fixed effects (FE) model. We then employ IV approach to cater for the endogeneity issue[8] that arises from correlation between the variable "travel" with the error term e^h, as shown in Equation (5). Since the variable p—a unit real cost of travel—appears only in Equation (5), but not in Equation (2), we use it as an instrumental variable. Besides, there do not exist any reasonable argument that the travel cost directly influences human capital development. Therefore, we obtain the reduced form equation as below:

$$Travel_{it} = \lambda_0 + \lambda_1 p_{it} + \lambda_2 \boldsymbol{X}_{it} + \lambda_3 \boldsymbol{X}_i^* + e_{it}^T, \tag{7}$$

where e^T is the error term. The unit real cost of international travel p is measured by the average cost of international inbound and outbound expenditures (including airfares and overboard expenses) per a passenger divided by consumer price index (see Table A2 of Appendix A for the details of all the variables used in this study).

We use an unbalanced annual dataset for 64 countries from 1995 to 2019.[9] We then select only countries with at least 10 years of data (see Table A1 of Appendix A for the list of the countries). The data of human capital index is sourced from the Penn World Table version 10.01 and the data for rest of variables is obtained from the World Devel-

[6]Purchasing Power Parity, 2021 real international price $.

[7]Domestic credit to private sector as percentage of gross domestic product is commonly used to gauge financial development (Pan, Dwumfour, and Kheng, 2024).

[8]Endogeneity issues can arise mainly because of omitted explanatory variables, measurement errors, and simultaneity. In our case, reverse causality is shown in the theoretical framework.

[9]The data of the key variables "travel" and "human capital" are jointly available only within this period

opment Indicators (WDI) of the World Bank. Table 1 presents the summary statistics of the variables.

Table 1: Summary statistics

	Mean	Std	Min	Max
Human capital index	2.817	0.563	1.364	3.892
School enrollment, secondary (% gross)	93.331	22.492	17.793	164.080
School enrollment, tertiary (% gross)	48.530	25.376	1.732	143.963
International travel (tourism openness)	1.630	1.600	0.007	8.948
Life expectancy	75.254	5.914	42.125	84.356
Average real cost of international travel	1.747	1.661	0.002	18.211
Gov't exp. on edu. per capita (PPP '0000)	15.756	14.153	0.168	69.167
Private credit per capita (PPP '0000)	282.772	328.381	0.745	1758.391
Income per capita (PPP '0000)	3.136	2.478	0.134	14.044

Note: The gross rates of school enrollment can exceed 100% if the number of students enrolled is greater than the number of students in the age group that corresponds to the educational level.

We can see that all variables are not concentrating around their means. For instance, human capital index ranges from 1.4 to 3.9 with the mean of 2.8 and the standard deviation of 0.6. International travel as a proportion of population varies from just 0.007 to almost 9 times of the population. Such spread of data provides a good sample for the empirical analysis. We also report the correlation matrix of all the variables in Table A3 of Appendix A.

4 Results and Discussion

4.1 Baseline results

We start with a simple pooled OLS estimation. The results in Table 2 show that the relationship between international travel and human capital development is positive and statistically significant at 1% level in all model specifications. The significant positive effect is robust across all three measurements (human capital index, secondary and tertiary enrollment rates) of human capital. However, the drawback of the OLS estimation is that it does not take into account for time-invariant variables such as innate ability. Therefore, we further use FE estimator to control for the time-invariant variables. The results of the FE estimation in Table 3 still show that the coefficients of our variables of interest are expected and statistically significant at the 1% level, indicating that an increase in international inbound and outbound travelers is significantly

Table 2: Human capital and international travel, OLS estimates

	Human capital index				Secondary enrollment				Tertiary enrollment			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
International travel	0.153***	0.058***	0.069***	0.057***	5.204***	0.886**	0.679*	0.100	5.313***	1.547***	1.676***	1.07647**
	(0.009)	(0.010)	(0.010)	(0.009)	(0.390)	(0.398)	(0.399)	(0.341)	(0.447)	(0.488)	(0.492)	(0.444)
Gov't exp. on edu. per capita		0.020***	0.007***	0.0005		0.904***	1.152***	0.828***		0.789***	0.634***	0.298***
		(0.001)	(0.002)	(0.002)		(0.045)	(0.079)	(0.069)		(0.055)	(0.098)	(0.090)
Private credit per capita			0.0006***	0.0004***			-0.012***	-0.023***			0.007*	-0.004
			(0.00008)	(0.00007)			(0.003)	(0.003)			(0.004)	(0.004)
Life expectancy				0.043***				2.107***				2.185***
				(0.003)				(0.103)				(0.134)
Observations	1,120	1,120	1,120	1,120	1,120	1,120	1,120	1,120	1,120	1,120	1,120	1,120
R-squared	0.19	0.37	0.40	0.52	0.14	0.37	0.37	0.55	0.11	0.25	0.25	0.40

Note: *, ** and *** denote statistical significance at the 10%, 5% and 1% levels, respectively.

Table 3: Human capital and international travel, FE estimates

	Human capital index				Secondary enrollment				Tertiary enrollment			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
International travel	0.100***	0.079***	0.080***	0.033***	3.426***	2.198***	2.219***	-0.351	7.575***	5.221***	5.335***	3.061***
	(0.006)	(0.007)	(0.007)	(0.005)	(0.440)	(0.469)	(0.469)	(0.408)	(0.531)	(0.548)	(0.537)	(0.507)
Gov't exp. on edu. per capita		0.012***	0.009***	0.001		0.663***	0.619***	0.227**		1.271***	1.028***	0.682***
		(0.001)	(0.001)	(0.001)		(0.100)	(0.105)	(0.089)		(0.116)	(0.120)	(0.110)
Private credit per capita			0.0002***	0.00010***			0.004	-0.005**			0.021***	0.0133***
			(0.00004)	(0.00003)			(0.003)	(0.002)			(0.003)	(0.003)
Life expectancy				0.051***				2.774***				2.455***
				(0.001)				(0.128)				(0.159)
Observations	1,120	1,120	1,120	1,120	1,120	1,120	1,120	1,120	1,120	1,120	1,120	1,120
R-squared	0.19	0.24	0.26	0.65	0.05	0.09	0.09	0.37	0.16	0.25	0.28	0.41
Number of countrycode1	64	64	64	64	64	64	64	64	64	64	64	64

Note: *, ** and *** denote statistical significance at the 10%, 5% and 1% levels, respectively.

associated with an increase in the formation of human capital. Although the OLS and FE estimators provide us with the results as anticipated, we proceed to deal with the endogeneity issue. Specifically, our theoretical framework reveals that we need to consider a simultaneity problem that occurs when human capital also promotes international travel. Intuitively, people should have a certain amount of knowledge, such as literacy and foreign languages, to travel overseas and navigate this complex world more confidently.

4.2 Main IV results

To deal with the issues related to both the issues of endogeneity and time-invariant factors, we adopt an FE instrumental estimator as one of our main estimation strategies. As we have only the real cost as an instrument, all our model specifications are exactly identified: each model has as many instruments as regressors. Table 4 reports the results of two-stage least square (2SLS) estimation. The coefficients of the key regressor are positive and statistically significant for almost all models, as well as those of life expectancy and per-capital private credit. However, government expenditure on education tends to have statistically insignificant association with the dependent variables in all but two specifications, in which it has a native sign and statistical significance. The likely reason might be that although government expenditure on education positively affects human capital through investment in schooling, this expenditure—funded by taxes—reduces households' budget, thus potentially leading to decline in investment in travel, which in turn can lead to lower level of human capital. We also present the first-stage regression output in Table 4. As predicted by the theory, demand for international travel negatively correlates with its cost with a statistical significance at the 1% level in all specifications.

4.3 A system of structural equations

Although the IV estimation provides the results as predicted by our theoretical model, the instrument that we employ is slightly weak: the correlation between the average travel cost and international travel is -0.25 and the Anderson-Rubin Wald-test statistic does not reject the null that the instrument is weak in all models. The weak instrument can lead to biased and inconsistent estimates. Furthermore, because human capital and international travel are jointly determined in the model, we further use a system of equations with a three-stage least square (3SLS) estimator, which is more efficient than a 2SLS as the former approach utilizes cross-equation information. The system consists of two equations as follows:

Table 4: Human capital and international travel, IV estimation

Second stage	Human capital index				Secondary enrollment				Tertiary enrollment			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
International travel	0.276***	0.316***	0.296***	0.032	13.302***	15.485***	15.026***	1.711	25.208***	28.493***	26.661***	23.715***
	(0.032)	(0.056)	(0.052)	(0.046)	(2.022)	(3.522)	(3.409)	(3.959)	(2.871)	(5.104)	(4.721)	(7.812)
Gov't exp. on edu. per capita		-0.008	-0.010**	0.002		-0.445	-0.476	0.092		-0.669	-0.795*	-0.669
		(0.005)	(0.005)	(0.003)		(0.318)	(0.318)	(0.273)		(0.461)	(0.440)	(0.538)
Private credit per capita			0.0003***	0.0001***			0.006*	-0.004			0.025***	0.0224***
			(0.00005)	(0.00003)			(0.004)	(0.003)			(0.005)	(0.006)
Life expectancy				0.051***				2.586***				0.572
				(0.004)				(0.382)				(0.753)
Observations	1,120	1,120	1,120	1,120	1,120	1,120	1,120	1,120	1,120	1,120	1,120	1,120
R-squared												
Number of countries	64	64	64	64	64	64	64	64	64	64	64	64
First stage	International travel											
	(1)	(2)	(3)	(4)								
Average cost of international travel	-0.148***	-0.094***	-0.096***	-0.056***								
	(0.017)	(0.016)	(0.016)	(0.016)								
Anderson-Rubin Wald-test: F-stat	117.85***	64.86***	59.87***	0.46	64.13***	34.45***	33.52***	0.19	151***	84.04***	78.24***	23.47***
Observations	1,120	1,120	1,120	1,120								
R-squared	0.07	0.18	0.18	0.24								
Number of countries	64	64	64	64								

Note: *, ** and *** denote statistical significance at the 10%, 5% and 1% levels, respectively.

$$h_{it} = a_0 + a_1 Travel_{it} + a_2 \mathbf{X}_{it} + a_3 \mathbf{X}_i^* + e_{it}^a, \tag{8a}$$

$$Travel_{it} = b_0 + b_1 h_{it} + b_2 p_{it} + b_3 y_{it} + b_4 \mathbf{Z}_i^* + e_{it}^b, \tag{8b}$$

where a_j and b_j are constant; $j = 0, 1, 3, 4$; y denotes per-capita income (PPP); $\mathbf{Z}^*$ is a vector of country's unobserved fixed effects on international travel; and e^a and e^b are the error terms. Note that that we use linear approximation of Equation (5) to obtain Equation (8b).

Prior to estimate the system of equations, we eliminate country fixed effects by using time-demeaned variables. Table 5 presents the estimates of the system. We begin with the results of Equation (8a). The coefficients of international travel are positively associated with human capital with statistical significance at 1% level when human capital index and tertiary enrollment are used as a proxy of human capital, and at 10% level when secondary enrollment is used. Life expectancy are also positive and statistically significant at 1% level in all the model specifications. However, government expenditure on education and private credit have the inconsistent signs and inconsistent statistical significance, depending on the measurement used as a proxy of human capital. Albeit, the results in system (3) are consistent with the estimates by FE and IV.

At the same time, human capital also has positive influence on international travel with statistical significance at 1% level across all of human capital's proxies. As predicted by the theory, income and cost positively and negatively affect demand for international travel, respectively, and their effects are also statistically significant at 10% to 1% level.

In summary, our results suggest that an increase in inbound and outbound visitors can enhance human capital development, which in turn empowers people to travel even more.

4.4 Robustness checks

4.4.1 Lewbel (2012) heteroscedasticity-based identification

We examine the robustness of our results by augmenting our external instruments with heteroskedasticity-based instruments constructed using Lewbel (2012)'s approach.

Table 5: Human capital and international travel, estimation of simultaneous equations (3SLS)

	System (1)		System (2)		System (3)	
	Human capital index	Int. travel	Secondary enrollment	Int. travel	Tertiary enrollment	Int. travel
	(a)	(b)	(a)	(b)	(a)	(b)
International travel	0.102***		2.658*		11.396***	
	(0.014)		(1.426)		(1.962)	
Gov't exp. on edu. per capita	-0.000		0.195**		0.425***	
	(0.002)		(0.096)		(0.101)	
Private credit per capita	0.000		-0.007***		0.006**	
	(0.000)		(0.002)		(0.003)	
Life expectancy	0.045***		2.436***		1.715***	
	(0.003)		(0.193)		(0.262)	
Human capital index		0.737***				
		(0.217)				
Average cost of international travel		-0.047*		-0.056**		-0.064***
		(0.026)		(0.027)		(0.019)
Income per capita		0.567***		0.559***		0.467***
		(0.079)		(0.082)		(0.095)
Secondary enrollment				0.016***		
				(0.004)		
Tertiary enrollment						0.015***
						(0.004)
Observations	1,120	1,120	1,120	1,120	1,120	1,120
R-squared	0.58	0.32	0.34	0.25	0.25	0.30

Note: *, ** and *** denote statistical significance at the 10%, 5% and 1% levels, respectively.

As argued in Lewbel (2012), the constructed instruments based on heteroskedasticity can be used when there are lack of external instruments and for testing the validity of external instruments. We briefly explain Lewbel (2012)'s approach as below. Consider the model,

$$Y_1 = X'\beta + Y_2\gamma + \varepsilon_1, \quad Y_2 = X'\alpha + \varepsilon_2$$

where ε_1 and ε_2 are the error terms which may be correlated, Y_1 is the dependent variable which is human capital index in our case, Y_2 is the endogenous variable, international travel, and X is the vector of control variables. One important issue is that it possibly that no element of X is excluded from the Y_1 equation, or it could be the case that any element β is zero. To deal with this issue, Lewbel (2012) develops an identification strategy based on two-stage least-squares (2SLS) estimator in the absence of external instruments for the endogenous variable, Y_2, by constructing valid instruments exploiting information contained in heteroskedasticity of ε_2. The model has the standard assumptions of non-singularity of the matrix $E(XX')$, and that $E(X\varepsilon_1) = E(X\varepsilon_2) = 0$. Furthermore, β and γ are assumed to be constants. There also several key assumptions for the Lewbel (2012) estimator, including $Cov(Z, \varepsilon_1\varepsilon_2) = 0$ and $Cov(Z, \varepsilon_2^2) \neq= 0$, and Z equals to X or is a subset of the elements of X. After estimating α and obtaining the residual from OLS regression of Y_2 on X, β and γ can be estimated using the 2SLS regression using X and $(Z - \bar{Z})\hat{\varepsilon}_2$ as instruments, where $\bar{Z}$ denotes the mean of Z.

Table 6 reports the results of the Lewbel (2012) IV estimates for human capital index used as the proxy for human capital. Columns (1) to (4) present the results based on the standard instrumental variable, columns (5) to (8) report the IV estimates using the constructed instruments, and columns (9) to (12) show the results using external instruments augmented by the constructed instruments. We can see that our results clearly show that the coefficient of international travel is positive and statistically significant in almost all regressions, which confirms the positive causal effect of international travel on human capital development. Our results also show that the standard IV estimates are quantitatively larger than the augmented model estimates. However, as documented in Lewbel (2012), the estimates from the augmented equation are more efficient. Overall, we find that international travel has a positive effect on human capital development, and our results are robust across the alternative specifications.

4.5 Bounding values and omitted variable bias

Given that the timeframe of our data includes a number of shocks such as the Global Financial Crisis (GFC) and the European debt crisis, one may argue that these can cause unobserved country heterogeneity, generating coefficient instability. For in-

Table 6: Lewbell (2012) IV estimates using heteroskedasticity-based instruments

VARIABLES	Standard IV				Generated IV				Generated and External IV			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
International travel	0.276***	0.317***	0.296***	0.032	0.108***	0.085***	0.081***	0.032***	0.109***	0.081***	0.078***	0.034***
	(0.062)	(0.078)	(0.076)	(0.066)	(0.004)	(0.004)	(0.003)	(0.003)	(0.004)	(0.004)	(0.003)	(0.003)
Gov't exp. on edu. per capita		-0.008	-0.010*	0.002		0.011***	0.009***	0.002***		0.012***	0.010***	0.002***
		(0.005)	(0.005)	(0.005)		(0.001)	(0.001)	(0.001)		(0.001)	(0.001)	(0.001)
Private credit per capita			0.0003***	0.0001*			0.0003***	0.0001***			0.0002***	0.00005**
			(0.000)	(0.000)			(0.000)	(0.000)			(0.000)	(0.000)
Life expectancy				0.051***				0.053***				0.053***
				(0.007)				(0.001)				(0.001)
Observations	1,120	1,120	1,120	1,120	1,120	1,120	1,120	1,120	1,120	1,120	1,120	1,120
Hansen J stat	-	-	-	-	229.89	204.59	185.44	229.86	233.80	231.56	233.13	227.54
Hansen J p-value	-	-	-	-	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Note: *, ** and *** denote statistical significance at the 10%, 5% and 1% levels, respectively.

stance, Nguyen, Castro and Wood (2024) find that banking crises have a more significant effect on human development and its components in developed countries, while debt and currency crises are more harmful in developing countries. Therefore, we examine the robustness of our results to omitted variable bias that may caused by unobserved country heterogeneity, such as these heterogeneous effects of financial crises.

In doing so, we adopt an approach for assessing estimation bias from unobservable factors developed by Oster (2019), which is useful in estimating the degree of selection on unobservables and establishes the lower bound that would confound the effect. Oster's (2019) approach utilizes information on coefficient and R-squared movements to obtain the bounding values for the treatment effect. Because observable covariates are assumed to be a random subset of all covariates that are relevant in the model, the underlying assumption is that the selection of the observable and unobservable covariates is assumed to be the same. Hence, a lower bound estimate can be calculated from movement in the coefficients following the inclusion of additional observable covariates.

We briefly describe the Oster's (2019) method as below.

$$\Delta h = \beta \Delta Travel + \gamma \omega^o + W_2 + \varepsilon$$

where h denotes human capital, $Travel$ is the treatment variable, ω^o is a vector of the observed covariates, W_2 is a vector of unobserved covariates. Denoting $W_1 = \gamma\omega^o$, where all elements of ω^o are assumed to be orthogonal to W_1, therefore W_1 and W_2 are orthogonal as well. The proportional selection relationship is $\delta\frac{\delta_1 Travel}{\delta_1^2} = \frac{\delta_2 Travel}{\delta_1^2}$, where $\delta_i Travel = Cov(W_i, Travel)$ and $\delta_i^2 = Var(W_i)$, for $i \in \{1,2\}$. The parameter δ is the coefficient of proportionality that captures the relative importance of observables and unobservables. For instance, $\delta = 1$ indicates that a degree of proportionality where observed and unobserved factors have equal importance.

The estimated coefficient and the R-squared from the unconditional regression of h on $Travel$ are defined as $\dot{\beta}$ and $\dot{R}$, respectively. The respective estimates from the controlled regression of h on $Travel$ and ω^o are defined as $\tilde{\beta}$ and $\tilde{R}$. Denote R_{max} as the R-squared from a hypothetical regression of h on all observable and unobservable covariates, including $Travel$. For the OLS estimates of $\dot{\beta}$ and $\tilde{\beta}$, the omitted variable bias is determined by the auxiliary regressions of each element of ω^o on $Travel$; W_2 on $Travel$; and W_2 on $Travel$ and ω^o. Based on the proportional selection relationship,

$\delta \frac{\delta_1 Travel}{\delta_1^2} = \frac{\delta_2 Travel}{\delta_1^2}$, the bias-adjusted treatment effect can be calculated as:

$$\beta^* \approx \tilde{\beta} - \delta[\dot{\beta} - \tilde{\beta}] \frac{R_{max} - \tilde{R}}{\tilde{R} - \dot{R}}$$

We use the suggested bounds for δ and R_{max} in Oster (2019), that is, $\delta = 1$ because it is unlikely that the unobservables have a larger impact than that of observables included in the model. Furthermore, Oster (2019) suggests a bound for R_{max}, in particular $R_{max} = min\{1.3\tilde{R}, 1\}$.

Table 7: Oster (2019) bound estimates

	(1) Controlled effect	(2) Identified set
	$\tilde{\beta}$(S.E.)	$[\tilde{\beta}, \beta^*(min\{1.3\tilde{R}, 1\}, 1)]$
Panel A: OLS estimation		
International travel	0.05717***(0.00882)	[0.05717, 0.15341]
Obs.	1,120	
$\tilde{R}^2$	0.51554	
Panel B: FE estimation		
International travel	0.03254***(0.00475)	[0.03254,0.09992]
Obs.	1,120	
$\tilde{R}^2$	0.65	

Note: *, ** and *** denote statistical significance at the 10%, 5% and 1% levels, respectively.

Table 7 presents the bounds of values for β from both of the OLS and FE models with full controls. For ease of comparison, column (1) reproduces the controlled-effect estimates for human capital index used as the proxy for human capital in Tables 2 and 3. It can be seen that the identified bounds of all the estimates in column (1) do not include zero, implying that our OLS and FE estimates are robust to the potential omitted variable bias. Moreover, we also consider the width of bound estimates. Specifically, the OLS estimated 0.06% increase in human capital development caused by a 1% rise in international travel is robust, but the bound is slightly larger at 0.15%. Similarly, the 0.03% rise in human capital development from the FE estimates is also robust, and the bound is again larger at 0.10%. Therefore, the Oster (2019) bounding analysis suggests the causal effect of international travel on human capital development, but of a marginally larger size than that presented in Tables 2 and 3 after considering the potential omitted variable bias.

5 Conclusions

In this paper, we present a simple, static theoretical model that shows how human capital, international travel, and other variables are linked. In doing so, we treat overseas travel not just mere consumption but also investment in human capital because travel does widen one's horizon. We then use a panel dataset of 64 countries over the period 1995-2019 to estimate the framework with the IV and a system of equations, as our main empirical strategies. Our results reveal that both human capital and international travel (tourism openness) are positively reinforcing each other. That is, a greater number of international inbound and outbound visitors are significantly associated with a greater amount of human capital, and vise versa. Our findings support policies that promote human mobility, school exchange programs or excursions, because one learns not just from schooling and training but also from observing others, so called "network effects".

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Appendix A

Table 1: Country list

OECD		Non-OECD		
Australia	Ireland	Albania	Kuwait	El Salvador
Austria	Iceland	Armenia	Sri Lanka	Eswatini
Belgium	Israel	Bangladesh	Morocco	Thailand
Canada	Italy	Bulgaria	Malta	Tajikistan
Switzerland	Japan	Brazil	Mauritius	Tunisia
Chile	Lithuania	Cyprus	Malaysia	Ukraine
Colombia	Luxembourg	Algeria	Nepal	Uruguay
Costa Rica	Latvia	Ecuador	Panama	Zimbabwe
Germany	Mexico	Fiji	Peru	.
Estonia	Netherlands	Guatemala	Philippines	.
Finland	Norway	Indonesia	Paraguay	.
France	Poland	India	Romania	.
Greece	Slovenia	Jordan	Russian Federation	.
Hungary	United States	Cambodia	Saudi Arabia	.

Table 2: Variable list

Variable Names	Notations
(1) Human capital index	hc
(2) population, total	SP.POP.TOTL
(3) Consumer price index (cpi) (2010 = 100)	FP.CPI.TOTL
(4) Life expectancy at birth, total (years)	SP.DYN.LE00.IN
(5) Domestic credit to private sector (% of GDP)	FS.AST.PRVT.GD.ZS
(6) Government expenditure on education, total (% of GDP)	SE.XPD.TOTL.GD.ZS
(7) Int. tourism, number of arrivals	ST.INT.ARVL
(8) Int. tourism, number of departures	ST.INT.DPRT
(9) GDP per capita, PPP (constant 2021)	NY.GDP.PCAP.PP.KD
(10) Int. Tourism, expenditures for passenger transport items	INT.TRNX.CD
(11) Int. Tourism, receipts for passenger transport items	INT.TRNR.CD
(12) School enrollment, Secondary (% gross)	SE.SEC.ENRR
(13) School enrollment, Tertiary (% gross)	SE.TER.ENRR

Note: We derive the following variables used in the models:

- Travel (tourism openness) = $(No.\ of\ arrivals + No.\ of\ departures)/population$
- Average real cost of travel = $\left(\frac{No.\ of\ arrivals}{receipts...items} + \frac{No.\ of\ departures}{expenditures...items}\right)/2cpi$
- Per-capita gov. exp. on edu. = $Gov.\ exp.\ on\ edu. \times GDP\ per\ capita$
- Per capita private credit = $Domestic\ credit... \times GDP\ per\ capita$

Table 3: Correlation matrix of all the variables

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
(1) Human capital index	1.00								
(2) Secondary enrollment	0.70	1.00							
(3) Tertiary enrollment	0.75	0.73	1.00						
(4) International travel	0.44	0.37	0.34	1.00					
(5) Average cost of int. travel	0.12	0.16	0.03	-0.25	1.00				
(6) Gov't exp. on edu. per capita	0.59	0.60	0.49	0.54	0.13	1.00			
(7) Private credit per capita	0.59	0.46	0.44	0.40	0.24	0.85	1.00		
(8) Income per capita	0.62	0.59	0.46	0.55	0.15	0.95	0.86	1.00	
(9) Life expectancy	0.67	0.69	0.61	0.39	0.15	0.65	0.62	0.67	1.00

Appendix B

The following proof responds to equation (5) that T is positive with respect to h. We reproduce equation (5) below and get rid of the subscript.

$$T = \frac{Y}{2p - \alpha\beta Y/h}.$$

Taking the first derivative of T with respect to h, we obtain

$$T' = \frac{Y'(2p - \alpha\beta Y/h) + \alpha\beta Y(Y'/h - Y/h^2)}{(2p - \alpha\beta Y/h)^2},$$

where x' (x = T, Y) is the first derivative of x with respect its argument (h). We need to show that the numerator is positive. Using the fact that $Y' = \alpha Y/h$, the numerator becomes

$$Y'(2p - \beta Y/h).$$

Next, with the assumption that $C, T > 0$, we obtain

$$p > \alpha\beta Y/h.$$

This inequality is the result of the first-order conditions of consumer's maximization problem. Because the labor share α exceeds 50%, we get

$$2p > 2\alpha\beta Y/h > \beta Y/h.$$

This proves that $T' > 0$.