DOCUMENTOS DE TRABAJO SOBRE

ECONOMÍA REGIONAL Y URBANA

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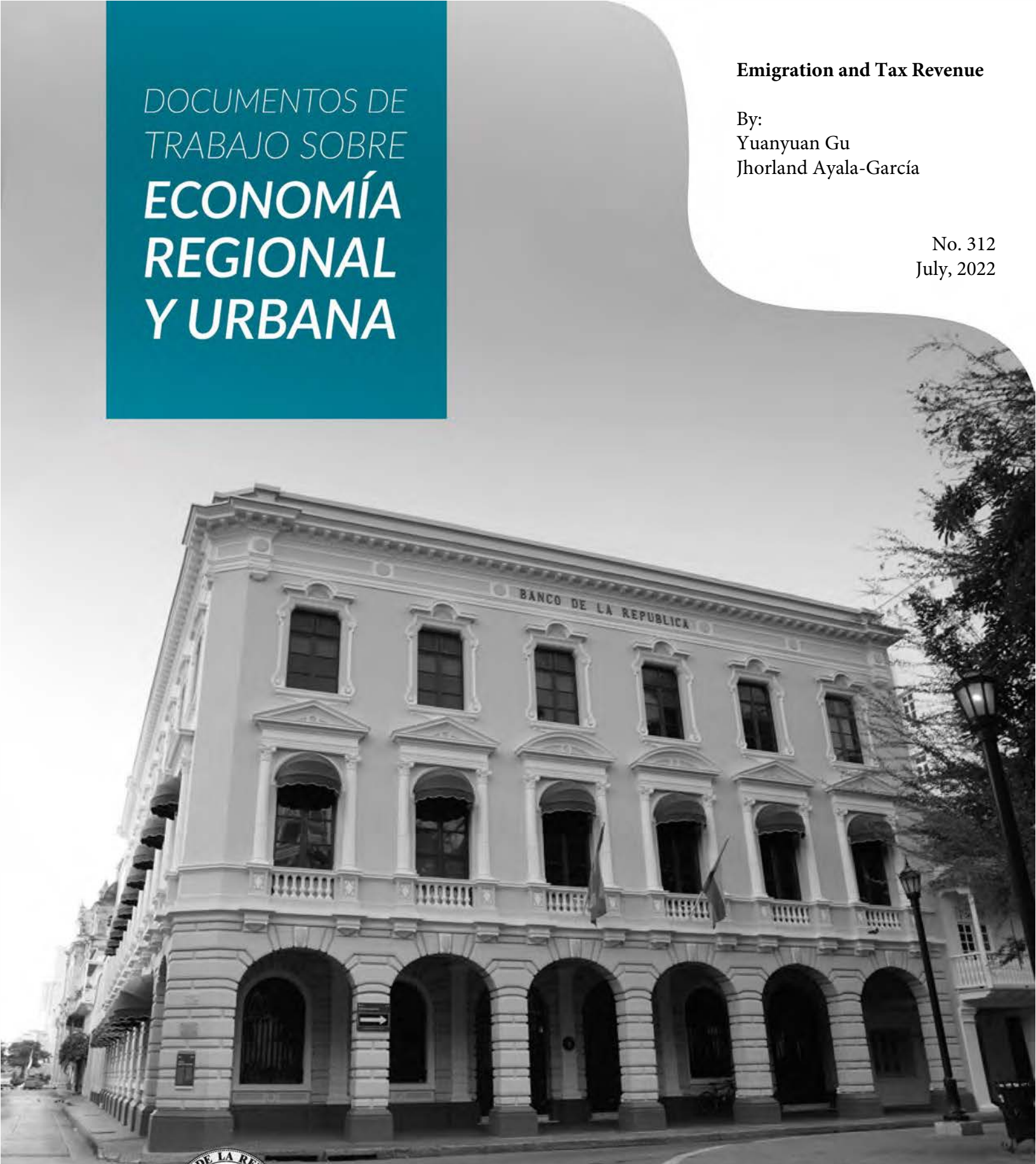
No. 312
July, 2022



BANCO DE LA REPÚBLICA
CENTRO DE ESTUDIOS ECONÓMICOS REGIONALES (CEER) - CARTAGENA

Emigration and Tax Revenue*

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Abstract

According to the World Migration Report 2020, the number of international migrants increased from 84 million in 1970 to 272 million in 2019, accounting for 3.5% of the world's population. This paper investigates the aggregated effect of emigration on the tax revenue of sending countries with a focus on developing nations. Using a gravity approach, we construct a time-varying exogenous instrument out of geographic time-invariant dyadic characteristics that allow us to estimate the predicted emigration rate for every country. Then, we follow an instrumental variable approach where we use our predicted emigration rate as an instrument of the observed migration rate. The results show that the predicted emigration rate is a good instrument of the current emigration rate for developing countries, and that there is a positive aggregated effect of emigration on tax revenue of sending countries. The results vary depending on the type of tax: emigration increases goods and services tax revenue, but it decreases income, profit, and capital gains tax revenue.

Key Words: Emigration, Tax Revenue, Developing Countries, Gravity
JEL Classification: H24, H25, F22, C26.

* The authors thank Jaime Bonet, Luis Armando Galvis, Karina Acosta, and Fernando Árias for their comments and suggestions, as well as those who attended the XVII *Seminario Interno de la Gerencia Técnica*.

Emigración y recaudo tributario[†]

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Resumen

Según el *World Migration Report* de 2020, el número de migrantes internacionales aumentó de 84 millones en 1970 a 272 millones en 2019, lo que representa el 3,5 % de la población mundial. Este documento investiga el efecto agregado de la emigración en los ingresos fiscales de los países de origen haciendo énfasis en países en vía de desarrollo. Usando un modelo de gravedad, construimos un instrumento exógeno que varía en el tiempo a partir de características diádicas geográficas invariantes en el tiempo, los cuales nos permiten estimar la tasa de emigración predicha para cada país. Luego utilizamos la tasa de emigración predicha como un instrumento de la tasa de migración observada. Los resultados muestran que la tasa de emigración pronosticada es un buen instrumento de la tasa de emigración de los países en desarrollo, y que existe un efecto agregado positivo de la emigración sobre los ingresos fiscales de los países de origen. Los resultados varían según el tipo de impuesto: la emigración aumenta los ingresos fiscales por impuestos sobre bienes y servicios, pero disminuye los ingresos por impuestos sobre la renta, las ganancias y las ganancias de capital.

Palabras clave: emigración, ingresos fiscales, países en desarrollo, gravedad.
Clasificación JEL: H24, H25, F22, C26.

[†] Los autores agradecen a Jaime Bonet, Luis Armando Galvis, Karina Acosta y a Fernando Árias por sus comentarios y sugerencias, así como a los asistentes al XVII seminario interno de la Gerencia Técnica.

1. Introduction

There is a close relationship between the capacity to raise fiscal revenue and development (Besley & Persson, 2009, 2013). While developed countries collect on average 40 percent of their GDP, developing countries collect between 10 and 20 percent (Besley & Persson, 2014). This difference allows developed nations to provide more and better public goods and services. As a result, it is imperative to explore the factors that affect revenue collection to increase our understanding of its determinants. Institutional capability, GDP per capita, the composition of output, and the degree of trade openness have been found as crucial determinants of tax revenue (Bird et al., 2008; Castro & Ramírez, 2014; Karagöz, 2013; Pessino & Fenochietto, 2010). This paper tries to contribute to this literature by studying the role of emigration on tax revenue in developing countries over the period 1990-2015. According to the World Migration Report 2020, the number of international migrants has increased over the last five decades, from 84 million in 1970 to 272 million in 2019, accounting for 3.5% of the world's population. Among all the migrants in 2019, approximately 141 million people live in Europe and North America.

The effect of emigration has been evaluated in a wide variety of settings, such as income (Filipski et al., 2020; Kannan & Hari, 2020; Wouterse & Taylor, 2008), income inequality (Uprety, 2020), education (Gatskova et al., 2019), and institutions (Docquier et al., 2016). Although there is evidence of the impact of remittances on tax revenue (Asatryan et al., 2017; Ebeke, 2014), little attention has been paid to the total effect of emigration on the tax revenue of the developing countries. There are different mechanisms through which emigration can affect public finances in the source country. First, emigrants represent a proportion of the labor force that is usually highly educated (Adams, 2003; Desai et al., 2009; Docquier & Rapoport, 2012), and 74% of them are in the working-age range of 20 to 64, representing a loss of human capital and productivity for the source countries (McAuliffe and Khadria, 2019). This has the effect that local firms need to pay higher salaries to find skilled labor, which in turn reduces profits and tax payments (Hanson, 2007; Mishra, 2007). Mishra (2007) estimates that emigration from Mexico to the United States between 1970 and 2000 increased the average wage of non-migrants Mexican workers by 8%. In a similar setting, Hanson (2007) studies how emigration affected regional labor supply and wages in Mexico, and finds a positive relationship between regional emigration rate and regional salary.

Second, a lower labor force in the country of origin may reduce income tax revenue given that higher-income population is emigrating. Docquier and Rapoport (2012) reveal that the share of high-skilled emigrants from low-income countries to the OECD countries increased from 37.5 to 45.3 percent between 1990 and 2000, while the low-skilled emigration share remained at 0.3 percent. Desai et al. (2009) show that the emigration wave from India to the United States concentrated highly educated, high earners and working-age population. The authors find that the negative fiscal impact of emigration for the Indian case reaches 2.5% of total fiscal revenue.

Finally, emigrants send money back to the origin countries as remittances, which increases consumption and tax revenue paid in goods and services. International remittances have grown from an estimated US$126 billion in 2000 to US$689 billion in 2020 (McAuliffe and Khadria, 2019). Asatryan et al. (2017) study the effect of remittances on tax revenue and tax policy of the receiving countries. The authors find that remittances increase value-added tax (VAT) revenue but do not affect income tax revenue. Similarly, Ebeke (2014) highlights that remittances increase the tax to GDP ratio and reduce tax revenue volatility in receiving countries that adopted a VAT. In addition, Singer (2012) finds that remittances are positively associated with total tax revenue in developing countries, which also increases total fiscal expenditure, while Abdih et al. (2012) show that remittances increase sales and trade tax revenue in the regions the Middle East, North Africa, and Central Asia. In the case of Mexico, Woodruff and Zenteno (2007) find that remittances increase investment, sales, and profits, which in turn increase tax revenue. Another important channel through which remittances can increase revenue is the development of the financial sector. For example, Aggarwal et al. (2011) find a positive relationship between remittances and bank and credit deposits to GDP ratios in developing countries, both indicators of financial development.

We start our assessment of the relationship between emigration and tax revenue with standard fixed-effects regressions. Evidently, there are different identification threats that need to be addressed. First, we may have measurement error problems given that we rely on migration data information from developing nations, which can bias our estimates (Angrist et al., 2021). Second, omitted factors can affect the consistency of our results because of the close relationship between migration and institutional or cultural factors that can also affect tax revenue. One example is the relationship between trade and institutions (Rigobon & Rodrik, 2005), which can also relate to migration. Using cross-country data from 1990 to 2020, we follow the approaches of

Asatryan et al. (2017) and Docquier et al. (2016) to identify the causal effect of emigration on tax revenue. In particular, we will use a set of geographical characteristics to construct a time-varying instrument for emigration. Our instrument consists of the predicted emigration rate out of the set of exogenous dyadic variables in a gravity model following Feyrer (2019). We take advantage of the changes in transportation technology that reduced the incidence of distance as a barrier to migration between countries.

Our results indicate that emigration increases total tax revenue in developing countries, with heterogeneous effects depending on the type of tax. For example, we find that income and corporate tax revenue decrease with a higher emigration rate, while goods and services and VAT taxes increase with a higher emigration rate. These results do not change under different robustness checks. Our findings indicate that the positive impact on consumption taxes offsets the negative effect on income and corporate tax revenue. The rest of the paper is organized into four sections. Section 2 shows our empirical strategy and our proposed solution to the identification threats it faces. Section 3 describes the data, the main results, and a set of robustness checks. Finally, section 4 presents the conclusions.

2. Empirical Strategy

This paper estimates the aggregated impact of emigration on tax revenue in developing countries. Additionally, we intend to test if there are heterogeneous effects of emigration depending on the type of tax that is considered. According to the literature, emigration can reduce personal and corporate income tax (Desai et al., 2009; Hanson, 2007; Mishra, 2007) because of the fewer human capital in the source country, but increase consumption and goods and services tax as a consequence of the remittances that emigrants send back to their origin countries (Abdih et al., 2012; Asatryan et al., 2017). We are interested in estimating the following regression model:

$$Y_{i,t} = \alpha m_{i,t} + \mathrm{X_{i,t}}\beta + \varphi_i + \theta_t + \mu_{i,t}. \quad (1)$$

Where $Y_{i,t}$ represents different dependent variables in per capita terms to explore the tax revenue response to emigration: (i) total tax revenue, (ii) income, profit, and capital gains tax revenue, (iii) VAT tax revenue, (iv) goods and services tax revenue, (v) personal income tax revenue, and (vi)

corporate income tax revenue. All our tax data are in constant 2017 international dollars (per capita purchasing power parity – PPP). $m_{i,t}$ is the emigration rate, which is calculated by the emigration stock from developing countries i to developed countries j at time t, $\sum_j M_{ij,t}$, divided by the native population of country i, $N_{i,t}$ (equal to the sum of the residents and emigrants). $X_{i,t}$ is a set of covariables that covers the main controls for tax revenue identified in the previous empirical literature, such as population, gross domestic product per capita, trade openness, net official development assistance (ODA), foreign direct investment (FDI), and exchange rate (Local Currency Unit – LCU per US$, period average). φ_i and θ_t are country and time fixed effects, respectively, $\mu_{i,t}$ is the standard error term.

We face several identification threats in our basic specification (Equation 1). First, emigration may not be exogenous to tax rates in developing countries. Emigrants from developing countries are mostly highly educated and have high earnings populations,which could face higher tax rates and fewer public goods in developing countries (Adams, 2003; Desai et al., 2009; Docquier & Rapoport, 2012). This may create incentives for emigration to developed nations, which could create a reverse causality problem between tax revenue and emigration. Second, it is uncertain whether the country fixed effects and all the control variables we choose can fully account for the omitted factors correlated with emigration. There may be unobservable characteristics at the country level that can affect the probability of emigrating and the amount of tax revenue that it collects, such as institutional and cultural characteristics.

As a result, OLS estimates may suffer from endogeneity, and we use an instrumental variable approach to address these identification threats. This requires finding a suitable instrument for emigration in the first stage, which is not an easy task. We follow Feyrer (2019) and Docquier et al. (2016) to construct an instrument for emigration based on past emigration stocks and a set of geographical characteristics. The proposed method allows us to estimate a time-varying instrument for emigration based on the exogenous geographical variation. In particular, we get the predicted bilateral emigration stocks from the following pseudo-gravity model using Pseudo Poisson Maximum Likelihood (PPML) with multiple levels of fixed effects (Santos Silva & Tenreyro, 2006, 2011):

$$M_{ij,t} = a_0 + \alpha_i + a_j + a_t + f_t(airdist_{ij} + seadist_{ij}) + \mathbf{Z_{ij}}\boldsymbol{\lambda} + \epsilon_{ijt} \qquad (2)$$

Where α_i, and a_j are the origin and destination country fixed effect respectively, a_t is a time fixed effect, $f_t(airdist_{ij}, seadist_{ij})$ is a function of air and sea distance that measures the bilateral resistance common in the gravity approach, and Z_{ij} is a set of dyadic characteristics such as sharing a border, sharing colonial history, or speaking the same language. This function is assumed to be similar for all countries in the same period, with coefficients that can change over time given by the following linear relationship,

$$f_t\left(airdist_{ij}, seadist_{ij}\right) = b_{air,t} airdist_{ij} + b_{sea,t} seadist_{ij}. \quad (3)$$

As a result, we will estimate the following equation:

$$M_{ij,t} = a_0 + \alpha_i + a_j + a_t + b_{air,t} airdist_{ij} + b_{sea,t} seadist_{ij} + \mathbf{Z_{ij}}\boldsymbol{\lambda} + \epsilon_{ijt} \quad (4)$$

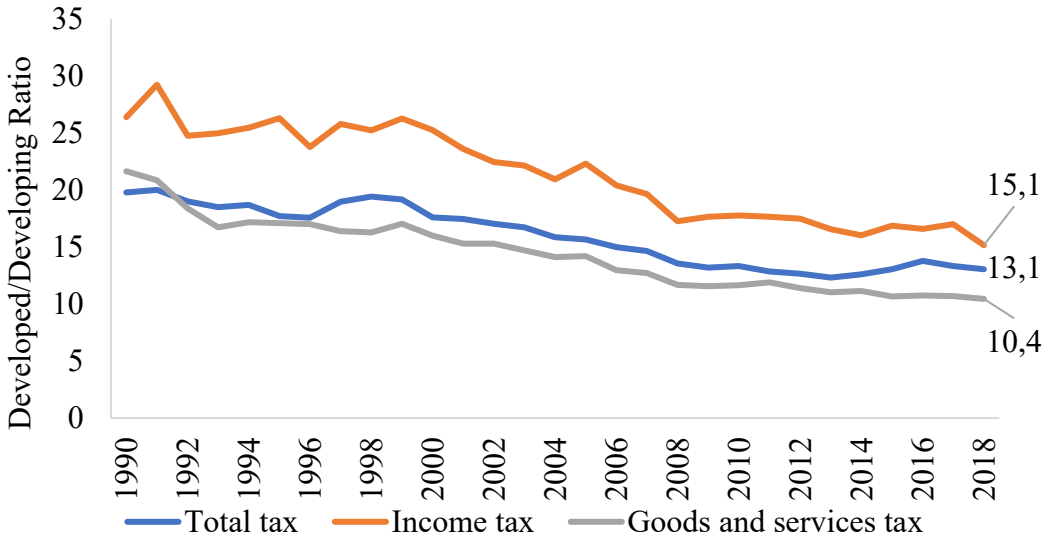
The distance between countries is calculated based on the geographical bilateral distance between the biggest cities of country i and county j, and those inter-city distances are weighted by the share of the city in the overall country's population (Head and Mayer, 2002). In equation (3), the change over time is assumed to be driven by transportation technological progress that "reduces" distance over time. The changes in transportation technology are captured by time dummies interected with both air and sea geographical distances, with a marginal effect of distance on migration given by $b_{air,t}$ and $b_{sea,t}$ at every year t, respectively. We expect $b_{air,t}$ and $b_{sea,t}$ decrease over time, indicating that because of the advances in transportation technology, the resistance of migration to geographical distance reduces over time.

With the predicted emigration stock for every pair of countries and every year t ($t = 1985, 1990, \ldots$) resulting from equation 3, $\widehat{M}_{ij,t}$, we aggregate bilateral migration stocks over destination countries to obtain the total emigration for origin countries, $\widehat{\sum_J M_{ij,t}}$, and then divide it by the native population of country i, $N_{i,t}$, to calculate the predicted emigration rate, $\widehat{m}_{i,t}$. We use the predicted emigration rate as the instrument variable in the first stage of regression. It is important to point out that our instrument may be correlated with trade which can, in turn, affect tax revenue, and ignoring this fact could threaten our exclusion restriction assumption, this is why we consider measures of openness to trade in our basic model of equation (1).

2.1 Data and Summary Statistics

The focus of our paper is on developing countries, which we define as those nations with a Gross National Income (GNI) per capita lower than USD 12.535 for 2020 and includes low- and middle-income countries, according to the classification of The World Bank. Following this definition, there are 165 developing countries in the database that are listed in Appendix 1. The tax revenue data comes from The International Centre for Tax and Development (ICTD). This is the richest existing database on cross-country tax revenues, which collects data from IMF Government Finance Statistics, IMF country reports, and OECD tax statistics. According to the available data, developed countries collected on average USD 10.520 per capita in 2015, representing 27.7% of GDP per capita, while developing countries only raised 806 per capita or 15.7% of their GDP per capita. Figure 1 shows the per capita tax revenue of developed countries divided by the tax revenue in developing nations from 1990 through 2018. The per capita tax revenue is higher for developed countries for total tax, income tax, and goods and services tax for the entire period, although the gap has reduced over time. Developed countries collected, on average, 13 times the total tax revenue per capita of developing countries, 10 times the goods and services tax, and 15 times the income tax in 2018. This tax revenue gap can help us understand why developed countries are able to provide more and better public goods and services to their citizens.

Figure 1. Tax revenue gap index between developed and developing countries by type of tax, 1990-2018.



Source: The authors with data from The International Centre for Tax and Development (ICTD).

We use the dataset on emigration from the *International Migration Stock 2020*, which provides estimates of the international migrant stock by age, sex, destination, and origin every five years from 1990 to 2020. That means that if $t = 1995$, then $t - 1 = 1990$ in our panel. As a result, our estimates come from a panel of developing countries from 1990 through 2015. A migrant is defined as a foreign born person according to national population censuses. We have information about emigration stocks for 192 countries, 119 of which can be classified as developing countries according to the definition of the World Bank. Figure 2 shows the evolution of the emigration rate per 1000 natives for the period 1990-2015. In general, total emigrants increased from 138.5 million to 226.9 million for the same period, where developing countries accounted for 76% of total emigrants. As a result, the emigration rate increased from 38.1 emigrants per 1000 natives in 1990 to 59.8 emigrants in 2015. Finally, data on population size, GDP per capita, trade openness, net ODA, FDI, Inflation, and exchange rate come from the *World Development Indicators* (WDI) of the World Bank. In addition, we use the *CEPII database* to get the air and sea distance between countries, which also contains the country-level information such as colonial relationships, shared borders, and common language. After cleaning up our different databases, we obtained an unbalanced panel of 109 developing countries. Table 1 provides summary statistics for our dependent and control variables.

Figure 2. Emigration rate, developing countries, 1990-2015.

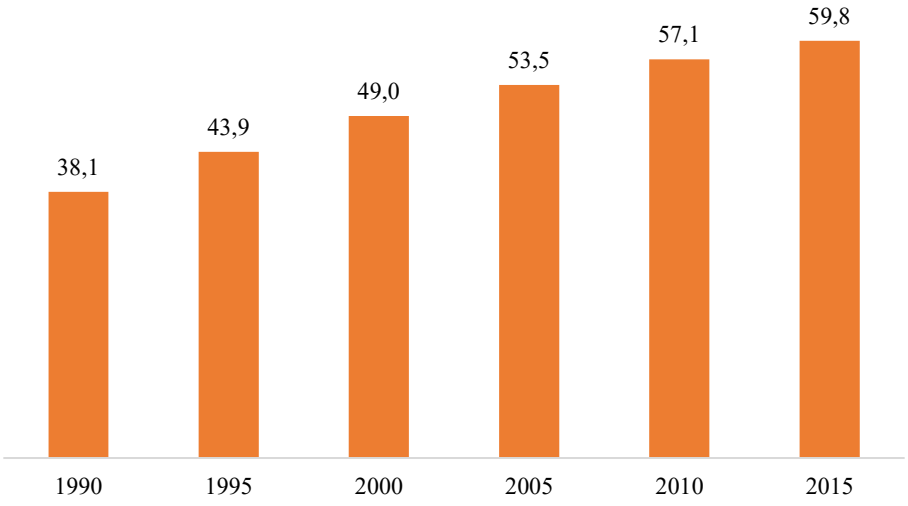


Table 1. Descriptive statistics

	Obs.	Mean	Std. Dev.	Min	Max
Total tax per capita	535	527.2	582.2	8.5	3792.1
Income tax per capita	447	150.6	182.4	0.8	1139.6
VAT per capita	275	142.2	170.1	0.0	974.9
Goods and services tax per capita	463	206.2	252.8	0.0	1648.9
Personal income tax per capita	360	65.1	96.5	0.0	726.4
Corporate income tax per capita	355	79.1	120.8	0.0	1339.9
Emigration rate (per 1000)	535	54.3	88.8	0.2	449.7
Population size (millions)	535	40.7	155.1	0.1	1371.2
Per capita GDP (USD, PPP)	535	2812.2	2605.2	210.8	18982.9
Openness to trade	535	59.1	31.0	8.0	192.1
Official Development Assistance	535	7.4	9.6	-0.2	77.9
Foreign Direct Investment	535	3.7	7.1	-10.3	103.3
Inflation (%)	535	46.0	377.8	-20.2	6261.2
Exchange rate	535	739.7	2482.7	0.0	29011.5

3. Results

Table 2 shows the OLS results for the relationship between emigration rate and different tax revenue measures of sending countries. Column (1) shows that there is a positive relationship between the emigration rate and total tax revenue, meaning that one more emigrant per 1000 natives increases the total tax revenue by 1.7 dollars per capita. However, the emigration rate seems to exhibit heterogeneous effects depending on the type of tax revenue that is considered. The emigration rate correlates negatively with total income tax revenue driven by its negative relationship with corporate income tax revenue. The OLS results also show a positive relationship between emigration rate and goods and services tax revenue. The control variables show the expected sign across the different models. GDP of the origin country increases tax revenue, as well as openness to trade and ODA, while inflation and exchange rate reduce it. However, as we discussed above, possible omitted factors and reverse causality may give rise to endogeneity, which can bias our results in OLS regressions. Therefore, in the following sub-section, we rely on instrumental variable regressions to identify the causal relationship between emigration rate and tax revenue per capita.

Table 2. OLS results

	(1)	(2)	(4)	(5)	(6)
	Total	***Income***	***Goods and Services***	***Personal Income***	***Corporate Income***
Emigration rate	1.747***	-0.463*	1.944**	0.047	-0.495***
	(0.531)	(0.270)	(0.776)	(0.171)	(0.160)
Population	-0.000	-0.000	0.000	-0.000	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
GDP pc (t-1)	0.131***	0.076***	0.047*	0.022***	0.050***
	(0.032)	(0.007)	(0.024)	(0.005)	(0.006)
Trade openness	1.490***	0.517***	0.623*	0.178	0.322
	(0.568)	(0.195)	(0.330)	(0.185)	(0.239)
ODA	2.925**	-0.125	0.609	-0.289	-0.165
	(1.356)	(0.337)	(0.710)	(0.290)	(0.216)
FDI	0.991	-0.163	2.303*	-0.104	-0.190
	(1.191)	(0.512)	(1.347)	(0.496)	(0.452)
Inflation	-0.055*	-0.011	-0.024	-0.007**	-0.014***
	(0.031)	(0.011)	(0.026)	(0.003)	(0.003)
Exchange rate	-0.012***	-0.004**	-0.006**	-0.003**	-0.003
	(0.003)	(0.002)	(0.003)	(0.002)	(0.003)
Constant	-89.986	-57.378***	-115.047*	-7.042	-43.589***
	(81.155)	(20.068)	(60.774)	(17.774)	(12.866)
Observations	535	482	509	395	387
Adjusted R-squared	0.644	0.702	0.484	0.367	0.639
Country FE	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES

Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

3.1 Instrumental Variable Approach

As we indicated above, we follow the approach of Feyrer (2019) and Docquier et al. (2016) to construct a time-varying exogenous instrument out of geographic characteristics. For that purpose, we estimate a "zero stage" gravity model where total emigration stock will be a function of geographic instruments and a set of dyadic controls. We take advantage of technological changes in the transportation industry to capture exogenous variation in emigration stocks. Table 3 shows the results of the "zero-stage" gravity model. We use geographical air and sea distance as our main exogenous instruments interacted with year dummies to capture the transportation industry's technological change. Our findings indicate that the effect of air distance on migration is negative but decreases over time. It means that distance is a barrier to emigration, but its impact has decreased over time due to the improvements in transportation technology (Figure 3). These findings differ from the effect of sea distance on migration, which, while also negative, are not decreasing over time, indicating that the transportation technology changes in sea transportation seem to have not accelerated emigration. The set of dyadic control variables shows the expected

sign. Colony, a dummy variable equal to 1 if countries i and j have a colonial relationship, shows a positive sign which means that having a historical colonial relationship facilitates emigration from a developing country to a developed one; Contiguity, a dummy variable equal to 1 if country i and county j share a border. The results show that sharing a border increases emigration, and Common language, a dummy variable equal to 1 if the same language is spoken by at least 9% of the population in both countries, also has a positive effect on emigration.

Table 3. Gravity Model Estimation

Dependent Variable: Emigration		
Air distance*Year		
	1990	-0.157***
		(0.0465)
	1995	-0.134***
		(0.0454)
	2000	-0.117***
		(0.0446)
	2005	-0.105***
		(0.0377)
	2010	-0.103***
		(0.0363)
	2015	-0.0977***
		(0.0374)
Sea distance*Year		
	1990	-0.0724**
		(0.0343)
	1995	-0.0842***
		(0.0308)
	2000	-0.0938***
		(0.0296)
	2005	-0.0982***
		(0.0295)
	2010	-0.100***
		(0.0311)
	2015	-0.0969***
		(0.0345)
Colony		1.530***
		(0.336)
Contiguity		1.610***
		(0.450)
Common Language		1.047***
		(0.218)
Constant		12.65***
		(0.246)
Observations		21,174
Pseudo *R-squared*		0.875

Notes: Origin, destination, and year fixed effects included. Errors standard clustered at origin and destination country. *** p<0.01, ** p<0.05, * p<0.1.

Figure 3. Air distance effect on emigration, marginal effect, 1990-2015.

Source: The authors.

The estimates of table 3 are then used to obtain the total predicted emigration stock from country *i* to all countries, which is needed to construct our instrumental variable, the predicted emigration rate for every origin country. The first-stage results are presented in table 4. We show the results, including only the emigration rate as the instrument (model 1) and considering all the instruments of the second stage (model 2). Our findings indicate that there is a positive and strongly significant relationship between predicted emigration rate and observed emigration rate. The F statistic is 582.4 in model 1 and 49.25 in model 2, showing that the instrument satisfies the relevance condition, and it has the expected sign. The predicted emigration rate captures variation in emigration rates across countries given by changes in transportation technology, under the assumption that all developing countries face the same emigration function every year. The results indicate that 1000 predicted emigrants will increase observed emigration by 391.

Table 4. First stage results.

Dep. Var: ***Emigration rate***	(1)	(2)
Predicted emigration rate	0.451***	0.391***
	(0.019)	(0.020)
Population		-0.000
		(0.000)
GDP pc (t-1)		0.000
		(0.000)
Trade openness		0.000
		(0.000)
ODA		0.000
		(0.000)
FDI		-0.000*
		(0.000)
Inflation		0.000
		(0.000)
Exchange rate		-0.000
		(0.000)
Constant	0.028***	0.024***
	(0.001)	(0.003)
Observations	714	603
Adjusted R-squared	0.394	0.461
Country FE	YES	YES
Year FE	YES	YES
F-test	582.4	49.25

Notes: Errors standard clustered in parenthesis. *** p<0.01, ** p<0.05, * p<0.1.

Table 5 presents the results for the second stage. As in Docquier et al. (2016) and Feyrer (2019), the gravity-based instrument shows a good performance. The findings indicate that the emigration rate has a positive effect on total per capita tax revenue (Column 1 on table 5). One more emigrant per 1000 natives increase total per capita tax revenue by USD 2.5, which suggests that the positive channels overcome the negative ones. We find evidence of heterogeneous effects depending on the type of tax revenue, as it has been found in the literature. For example, emigration reduces income tax revenue in the source country, a result that is consistent with the findings in Desai et al. (2009) for the case of India, where the emigration wave of the highly educated population decreased tax revenue by about 2.5% per year. Our results can be explained by the effect that emigration has on local firms of sending countries. As it can be seen in column 5 of table 5, emigration reduces the corporate income tax revenue per capita, but it has no effect on personal income tax revenue per capita. These results are consistent with the hypothesis that emigration causes local firms to pay higher salaries to be able to find skilled labor, given demographic

characteristics of emigrants, which are a young and usually high educated portion of the population. The higher salaries reduce profits and tax payments from corporations. Finally, the per capita goods and services tax revenue is positively affected by emigration. Emigrants send money to their origin country as remittances, and this money can increase household consumption, which in turn increases goods and services tax revenue. The empirical evidence is consistent with the existing literature. For example, Asatryan et al. (2017) find that remittances increase VAT taxes, but have no effect on personal income tax revenue.

Table 5. Second stage results

	(1)	(2)	(3)	(4)	(5)
	Total	***Income***	***Goods and Services***	***Personal Income***	***Corporate Income***
Predicted emigration rate	2.468***	-0.939**	4.588***	-0.123	-1.218***
	(0.891)	(0.416)	(0.943)	(0.446)	(0.392)
Population	-0.000	-0.000	0.000	-0.000	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
GDP pc (t-1)	0.130***	0.077***	0.042**	0.022***	0.053***
	(0.032)	(0.007)	(0.021)	(0.005)	(0.007)
Trade openness	1.583***	0.458**	0.888**	0.158	0.229
	(0.561)	(0.204)	(0.407)	(0.195)	(0.245)
ODA	2.925**	-0.129	0.705	-0.302	-0.242
	(1.322)	(0.391)	(0.929)	(0.322)	(0.310)
FDI	0.957	-0.126	2.024	-0.075	-0.120
	(1.182)	(0.496)	(1.232)	(0.509)	(0.488)
Inflation	-0.056*	-0.011	-0.027	-0.007**	-0.013***
	(0.032)	(0.011)	(0.028)	(0.003)	(0.003)
Exchange rate	-0.011***	-0.004**	-0.003	-0.004**	-0.004*
	(0.003)	(0.002)	(0.002)	(0.002)	(0.003)
Constant	-125.417	-35.692	-232.001***	0.470	-13.026
	(78.439)	(24.796)	(66.398)	(27.699)	(21.345)
Observations	535	482	509	395	387
Country FE	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES

Robust standard errors clustered by country *** p<0.01, ** p<0.05, * p<0.1.

3.2 Robustness Checks

We went to evaluate the consistency of our results depending on the sample of countries. The findings of table 5 come from a sample of emigrants from developing countries to developed nations between 1990 and 2015. First, we exclude socialist countries of the sample (Vietnam, Cuba, Lao PDR, China Mainland) because these countries have strict controls on emigration. In general, the results remain unchanged, as it can be seen in table 6. The emigration rate increases total tax

revenue, reduces income tax revenue because of its effect on corporate income tax revenue, and increases goods and services tax revenue. The aggregated effect is positive, indicating that the positive effect on goods and services tax revenue overtakes the negative effect on income tax revenue given by the negative impact on corporate income tax revenue. Then, we estimate the results considering all countries as origin countries, which results can be seen in table 7. There is a positive effect of emigration rate on total tax revenue that is explained mainly by the effect of emigration on goods and services tax revenue, as it can be seen in columns (1) and (3) of table 7. The effect of emigration on corporate income tax revenue disappears after considering emigration from rich countries, which can explain why total income tax revenue is not affected by the emigration rate in table 7 (columns 5 and 2, respectively).

Table 6. Emigration rate and tax revenue, excluding socialist countries.

	(1)	(2)	(3)	(4)	(5)
	Total	***Income***	***Goods and Services***	***Personal Income***	***Corporate Income***
Predicted emigration rate	2.533***	-0.963**	4.666***	-0.155	-1.251***
	(0.888)	(0.426)	(0.951)	(0.454)	(0.415)
Population	-0.000	-0.000	-0.000	-0.000	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
GDP pc (t-1)	0.128***	0.079***	0.037*	0.023***	0.055***
	(0.031)	(0.007)	(0.019)	(0.006)	(0.008)
Trade openness	1.743***	0.530**	0.968**	0.175	0.251
	(0.610)	(0.223)	(0.435)	(0.215)	(0.265)
ODA	2.845**	-0.170	0.649	-0.326	-0.281
	(1.307)	(0.388)	(0.935)	(0.328)	(0.308)
FDI	0.856	-0.053	1.802	-0.038	-0.042
	(1.156)	(0.479)	(1.166)	(0.516)	(0.502)
Inflation	-0.057*	-0.010	-0.028	-0.007**	-0.012***
	(0.032)	(0.011)	(0.028)	(0.003)	(0.003)
Exchange rate	-0.011***	-0.004**	-0.003	-0.005***	-0.005
	(0.004)	(0.002)	(0.002)	(0.002)	(0.006)
Constant	-129.578	-49.100*	-215.079***	-4.086	-21.033
	(81.754)	(25.785)	(65.748)	(29.897)	(22.474)
Observations	520	467	494	381	373
Country FE	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES

Robust standard errors clustered by country *** p<0.01, ** p<0.05, * p<0.1.

Table 7. Emigration rate and tax revenue, all countries as origin countries.

	(1)	(2)	(3)	(4)	(5)
	Total	***Income***	***Goods and Services***	***Personal Income***	***Corporate Income***
Predicted emigration rate	3.810***	0.406	6.733***	0.025	0.339
	(1.365)	(0.916)	(2.060)	(0.470)	(1.112)
Population	0.000	-0.000	0.000	-0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
GDP pc (t-1)	0.153***	0.089***	0.062***	0.025***	0.030*
	(0.034)	(0.022)	(0.022)	(0.006)	(0.015)
Trade openness	2.048**	1.282*	2.076	0.267	0.675
	(0.805)	(0.719)	(1.536)	(0.223)	(0.697)
ODA	3.209	-0.534	1.320	-0.052	-0.845
	(1.965)	(0.663)	(1.470)	(0.296)	(0.756)
FDI	2.379	0.868	3.724	1.095	0.898
	(2.068)	(0.877)	(2.296)	(0.935)	(0.989)
Inflation	-0.057*	-0.015	-0.016	-0.005*	-0.027**
	(0.033)	(0.014)	(0.028)	(0.003)	(0.012)
Exchange rate	-0.010***	-0.002	-0.004	-0.004**	-0.001
	(0.003)	(0.002)	(0.003)	(0.002)	(0.006)
Constant	-275.808*	-195.318	-522.438**	-29.270	-20.332
	(142.594)	(123.168)	(207.732)	(39.200)	(56.900)
Observations	615	564	591	452	456
Country FE	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES

Robust standard errors clustered by country *** p<0.01, ** p<0.05, * p<0.1.

4. Conclusion

Tax revenue is the primary tool that governments have to provide goods and services, and it can be affected by local policies and international shocks in the case of developing countries. This paper studies the impact of emigration on tax revenue on sending countries for the case of developing countries. We follow a two-stage approach where, in the first stage, we take advantage of a time-varying exogenous instrument of emigration rate. This time-varying instrument was constructed with a pseudo-gravity model where total emigration depends on dyadic geographic characteristics and time interactions that capture technological change in the air transportation industry. The instrument proves to be relevant and a powerful predictor of current emigration rates for developing countries. The results are robust to the inclusion of a set of control variables usually considered in the literature specialized on the determinants of tax revenue.

Our findings indicate that the overall effect of emigration on the tax revenue is positive, with heterogeneous effects depending on the type of tax. Specifically, emigration decreases income, profit, and capital gains tax revenue, while it increases goods and services tax revenue. One more emigrant per 1000 natives can increase per capita goods and services tax revenue by USD 4.6 while reducing per capita income per capita tax revenue by USD 0.9. The positive effect on per capita goods and services tax revenue offsets the negative impact on per capita income tax revenue, allowing total per capita income tax revenue to increase by USD 2.5. Overall, the results seem robust over different specifications.

Finally, we find some differences on the impact of migration depending on the countries of origin, which suggests that the effect of emigration on origin countries' public finances is origin specific. The impact of emigration on total tax revenue is larger when we consider all countries as origin countries, caused by the null effect of emigration on income tax revenue when developed nations are considered in the sample as countries of origin. Our findings are consistent with the empirical evidence suggesting that remittances are an important mechanism through which developing countries can increase tax revenue, a result that is not origin – specific. Therefore, we conclude that emigration to developed countries played an important positive role in boosting tax revenue in developing nations.

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Appendix

Appendix 1. List of Developing Countries

Country	GNI 2019	Country	GNI 2019
Afghanistan	530	St. Lucia	11080
Angola	2970	Sri Lanka	4010
Albania	5220	Lesotho	1290
Argentina	11130	Morocco	3200
Armenia	4680	Moldova	4580
Azerbaijan	4490	Madagascar	510
Burundi	280	Maldives	9670
Benin	1250	Mexico	9480
Burkina Faso	780	Marshall Islands	5010
Bangladesh	1940	North Macedonia	5840
Bulgaria	9570	Mali	870
Bosnia and Herzegovina	6180	Myanmar	1360
Belarus	6370	Montenegro	9070
Belize	4700	Mongolia	3790
Bolivia	3520	Mozambique	490
Brazil	9270	Mauritania	1660
Bhutan	3140	Malawi	550
Botswana	7660	Malaysia	11230
Central African Republic	520	Namibia	5180
China	10390	Niger	600
Cote d'Ivoire	2290	Nigeria	2030
Cameroon	1500	Nicaragua	1900
Congo (DRC)	530	Nepal	1230
Colombia	6580	Pakistan	1410
Comoros	1400	Peru	6790
Costa Rica	12070	Philippines	3850
Djibouti	3310	Papua New Guinea	2750
Dominica	7870	Paraguay	5510
Dominican Republic	8100	Russian Federation	11250
Algeria	4010	Rwanda	830
Ecuador	6100	Sudan	820
Egypt	2690	Senegal	1430
Ethiopia	850	Solomon Islands	2370
Fiji	5800	Sierra Leone	540
Micronesia, Federated States of	4010	El Salvador	3990
Gabon	7170	Somalia	320
Georgia	4690	Serbia	7030
Ghana	2210	Sao Tome and Principe	1950
Guinea	950	Suriname	6340
Gambia, The	750	Eswatini	3670
Guinea-Bissau	800	Chad	700

Equatorial Guinea	6280	Togo	920
Grenada	9830	Thailand	7260
Guatemala	4610	Tajikistan	1070
Guyana	6630	Turkmenistan	7220
Honduras	2390	Timor-Leste	2020
Haiti	1330	Tonga	5000
Indonesia	4050	Tunisia	3340
India	2120	Turkey	9690
Iran	3640	Tuvalu	5620
Iraq	5490	Tanzania	1100
Jamaica	5260	Uganda	780
Jordan	4410	Ukraine	3370
Kazakhstan	8820	Uzbekistan	1800
Kenya	1750	St. Vincent/Grenadines	7460
Kyrgyzstan	1240	Vietnam	2590
Cambodia	1530	Vanuatu	3360
Kiribati	3340	Samoa	4200
Laos	2490	South Africa	6040
Lebanon	7420	Zambia	1430
Liberia	580	Zimbabwe	1200
Libya	7640		