Online Appendix

"Estimating the Effect of Immigration on Public Finances: Evidence from the influx of Venezuelan migrants to Colombia"

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A. Additional Tables and Figures

Table A1

Welfare dependency: immigrant-native differences in welfare-take up probabilities and transfer values using the restricted sample

	Welfare Take-up Probability				*Level of Receipts (thousands)*
	Any Welfare	*Health Care*	*Pension*	*Cash Assitance*	
Panel (a): Immigrants by group					
Returnees	0.106*	0.153**	– 0.067***	– 0.047***	– 108.1***
	(0.006)	(0.006)	(0.009)	(0.002)	(38.5)
Venezuelan-born	0.068***	0.074***	– 0.062***	– 0.017***	146.4
	(0.009)	(0.009)	(0.015)	(0.003)	(199.9)
Other	– 0.115***	– 0.108***	– 0.114***	– 0.022***	407.7
	(0.014)	(0.014)	(0.015)	(0.004)	(303.0)
Panel (b): Venezuelan-born immigrants by cohort					
Arrived in or before 2015	0.092***	0.096***	– 0.048**	– 0.006	192.7
	(0.012)	(0.012)	(0.019)	(0.005)	(215.2)
Arrived after 2015	0.038***	0.046***	– 0.093***	– 0.030***	– 310.1
	(0.013)	(0.013)	(0.021)	(0.003)	(254.9)
Predicted probability of welfare take-up for permanent natives	0.465	0.454	0.163	0.080	–
Fraction of predicted prob. in the (0,1) interval	0.994	0.994	0.875	0.807	–
Year fixed effects	Yes	Yes	Yes	Yes	Yes
Individual covariates	Yes	Yes	Yes	Yes	Yes
Sample size	3,925,120	3,925,120	405,087	3,925,120	257,566

Notes. The unit of analysis is the individual. We restrict the sample to those affiliated to the SGSSS. We consider all persons 10 years of age or older except for pension benefits in which case we consider all female age 54 or older and males age 59 or older. Panel *(a)* considers all immigrant groups in fiscal years 2013–2018, while panel *(b)* focuses on Venezuelan immigrants (including returnees) by cohort. Cash assistance includes *Más Familias en Acción, Jóvenes en Acción*, unemployment benefits, *Colombia Mayor*, social housing programs, and other cash transfers from national and local governments. The level of receipts is the self-reported value for cash assistance excluding unemployment for which we don't have information. We drop observations with no reported value or values below ten thousand pesos and discount them using the 2018 CPI. Controls include age, a dummy variable for females, family size, monthly wage, annual nonlabor and nontransfer income, and a dummy variable for those living in an urban area. Estimates are weighted by sampling weights reported in the GEIH. Robust standard errors in parentheses. *** Denotes significance at 1%, ** significance at 5% and * significance at 10%.

Table A2

Net fiscal impact by scenario and level of government without royalties, 2013-2018

	Panel *(a)*: average effect			
	Natives		*Venezuelan-born*	*Other*
	Permanent	*Returnees*		
(1) Overall net fiscal contributions (COP$ million, 2018 equivalent)				
National	–275,720,784	–1,056,913	–1,737,454	1,239,813
Regional and Local	52,649,830	–96,984	–1,142,921	2,481,521
Total	–223,070,954	–1,153,897	–2,880,374	3,721,334
Percent of GDP (%)	–3.99	–0.02	–0.05	0.07
(2) Ratio of real revenues to real expenditures				
National	0.762	0.685	0.702	1.223
Regional and Local	1.100	0.951	0.708	2.754
Total	0.868	0.783	0.705	1.534
(3) Revenues/expenditures ratio, relative to permanent natives				
National	–	0.899	0.922	1.605
Regional and Local	–	0.864	0.644	2.504
Total	–	0.903	0.812	1.768
	Panel *(b)*: marginal effect			
	Natives		*Venezuelan-born*	*Other*
	Permanent	*Returnees*		
(1) Overall net fiscal contributions (COP$ million, 2018 equivalent)				
National	–276,349,413	–1,002,083	–1,270,554	1,346,713
Regional and Local	51,692,969	89,900	–505,601	2,614,180
Total	–224,656,445	–912,183	–1,776,156	3,960,893
Percent of GDP (%)	–4.02	–0.02	–0.03	0.07
(2) Ratio of real revenues to real expenditures				
National	0.762	0.649	0.739	1.258
Regional and Local	1.098	1.057	0.833	3.180
Total	0.867	0.795	0.775	1.618
(3) Revenues/expenditures ratio, relative to permanent natives				
National	–	0.852	0.970	1.652
Regional and Local	–	0.962	0.759	2.896
Total	–	0.917	0.894	1.866

Notes. Panel *(a)* reports estimates when we impute to immigrants the average cost of public goods provision. Panel *(b)* reports the estimates under the assumption that immigrants pay the marginal cost, assumed to be zero. In each case we report at different levels of government for permanent natives, returnees, Venezuelan-born and other immigrants, cumulated over fiscal years 2013–2018: (1) their overall net fiscal contribution, expressed in 2018 equivalent COP, (2) the ratio of revenues contributed to expenditures received in real terms, and (3) the revenues/expenditures ratio for each immigrant group relative to permanent natives. We include revenues and expenditures for social security as part of the national government. We use gross domestic product implicit price deflator to estimate equivalent COP.

Table A3

Marginal per capita fiscal impact by group and cohort
(COP$ million, 2018 equivalent)

	All sample		*Independent person unit*		
	(1)	*(2)*	*(3)*	*(4)*	*(5)*
Panel (a): Immigrants by group					
All immigrants	– 4.911***	– 4.655***	– 6.839***	– 7.442***	– 7.599***
	(0.321)	(0.321)	(0.532)	(0.533)	(0.519)
Returnees	– 6.347***	– 6.507***	– 11.14***	– 11.53***	– 9.230***
	(0.240)	(0.240)	(0.357)	(0.355)	(0.347)
Venezuelan-born	– 8.010***	– 7.479***	– 10.77***	– 11.73***	– 11.80***
	(0.290)	(0.289)	(0.546)	(0.549)	(0.533)
Other	5.444***	5.544***	13.20***	13.04***	7.331***
	(1.376)	(1.374)	(2.567)	(2.561)	(2.529)
Panel (b): Venezuelan-born immigrants by cohort					
Arrived in or before 2015	1.362*	2.000***	6.073***	5.434***	4.421***
	(0.716)	(0.714)	(1.734)	(1.738)	(1.686)
Arrived after 2015	– 12.56***	– 12.07***	– 16.31***	– 17.38***	– 17.14***
	(0.228)	(0.227)	(0.399)	(0.400)	(0.393)
Controls:					
Age	–	Yes	–	Yes	Yes
Sex	–	Yes	–	Yes	Yes
Education	–	–	–	–	Yes
Number of dependents	–	–	–	–	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes
Sample size	4,681,880	4,681,880	3,243,056	3,243,056	3,243,056

Notes. The Table reports OLS regression coefficients of the net fiscal impact (dependent variable) on dummy variables for immigrant's group/cohort after controlling for demographic characteristics. Panel *(a)* considers all immigrant groups, while panel *(b)* focuses on Venezuelan-born immigrants by cohort. Coefficients indicate the marginal per capita fiscal impact that is associated with each group/cohort relative to the net contributions of permanent natives. We report results for the marginal cost scenario over fiscal years 2013–2018. Data are based on our own fiscal estimates following Tables 1 and 2 and GEIH data, adjusted by a single multiplicative factor so that the population-weighted aggregate is consistent with totals of our budget estimates of government receipts and expenditures. All public spending is included in benefits.

Columns 1 and 2 takes as the unit of analysis all individual observations. Columns 3 to 5 exclude dependents from the unit of analysis, defined as any person *(i)* under the age of 18, *(ii)* from 18 to 22 years old and enrolled full time in secondary education, or *(iii)* from 18 to 22 years old in higher education or not, and who is working less than half time; if a person is married, they are considered independent, regardless of their age. However, each dependent's fiscal flows are assigned equally to all independent person(s) to whom they are linked.

Education groups are: *(i)* less than HS, *(ii)* HS graduate, *(iii)* some college, *(iv)* bachelor's degree, *(v)* any post bachelors.

Estimates are weighted by sampling weights reported in the GEIH. Robust standard errors in parentheses. *** Denotes significance at 1%, ** significance at 5% and * significance at 10%.

Table A4

Descriptive statistics for Venezuelan immigrants by moving status within the last 12 months

Characteristic	Mover	SE	Non- mover	SE	Difference	t-stat
Male	0.55	0.012	0.518	0.003	0.032	2.638
Average Age (years)	24.62	0.353	26.01	0.099	–1.389	–3.789
Percent Age 15-24	0.231	0.010	0.176	0.002	0.056	5.513
Percent Age 25-54	0.445	0.012	0.444	0.003	0.001	0.082
Avg. years of schooling (age 15+)	9.078	0.109	9.222	0.030	–0.145	–1.278
Percent College Grads (age 25+)	0.083	0.009	0.113	0.003	–0.030	–3.152

Notes: The table reports descriptive statistics by internal migration status. *Source.* Authors' estimates using data from the 2013-2018 GEIH.

Table A5

Net fiscal impact for Venezuelan immigrants at the local level excluding national transfers, 2013-2018

Panel *(a)*: average per capita net fiscal contributions *(COP$ 2018 equivalent)*

	Average Effect	*Marginal Effect*		*Average Effect*	*Marginal Effect*
Armenia	98,095	318,244	Neiva†	137,126	276,115
Barranquilla	–383,243	–135,789	Pasto†	–1,793,200	–350,446
Bogotá	–645,458	–420,185	Pereira	4,864	245,149
Bucaramanga	–318,697	–97,384	Popayán†	86,401	151,669
Cali	–767,640	75,733	Quibdó†	402,145	534,691
Cartagena	–70,636	167,547	Riohacha	382,033	365,832
Cúcuta	–922,408	118,558	Santa Marta	49,644	221,702
Florencia†	–	–	Sincelejo	118,269	266,913
Ibagué†	126,326	341,174	Tunja	–322,054	16,441
Manizales	–107,538	85,727	Valledupar	112,122	270,877
Medellín	–532,528	–511,932	Villavicencio	–97,279	143,121
Montería	427,280	537,703			

Panel *(b)*: ratio of real revenues to real expenditures

	Average Effect	*Marginal Effect*		*Average Effect*	*Marginal Effect*
Armenia	1.140	1.575	Neiva†	1.128	1.364
Barranquilla	0.705	0.824	Pasto†	0.438	0.770
Bogotá	0.586	0.608	Pereira	1.041	1.381
Bucaramanga	0.698	0.843	Popayán†	1.080	1.170
Cali	0.551	0.938	Quibdó†	1.467	1.816
Cartagena	1.057	1.370	Riohacha	1.964	2.140
Cúcuta	0.445	1.118	Santa Marta	1.034	1.253
Florencia†	–	–	Sincelejo	1.020	1.163
Ibagué†	1.133	1.473	Tunja	0.799	1.108
Manizales	0.889	1.152	Valledupar	1.091	1.331
Medellín	0.759	0.717	Villavicencio	0.911	1.192
Montería	1.490	1.796			

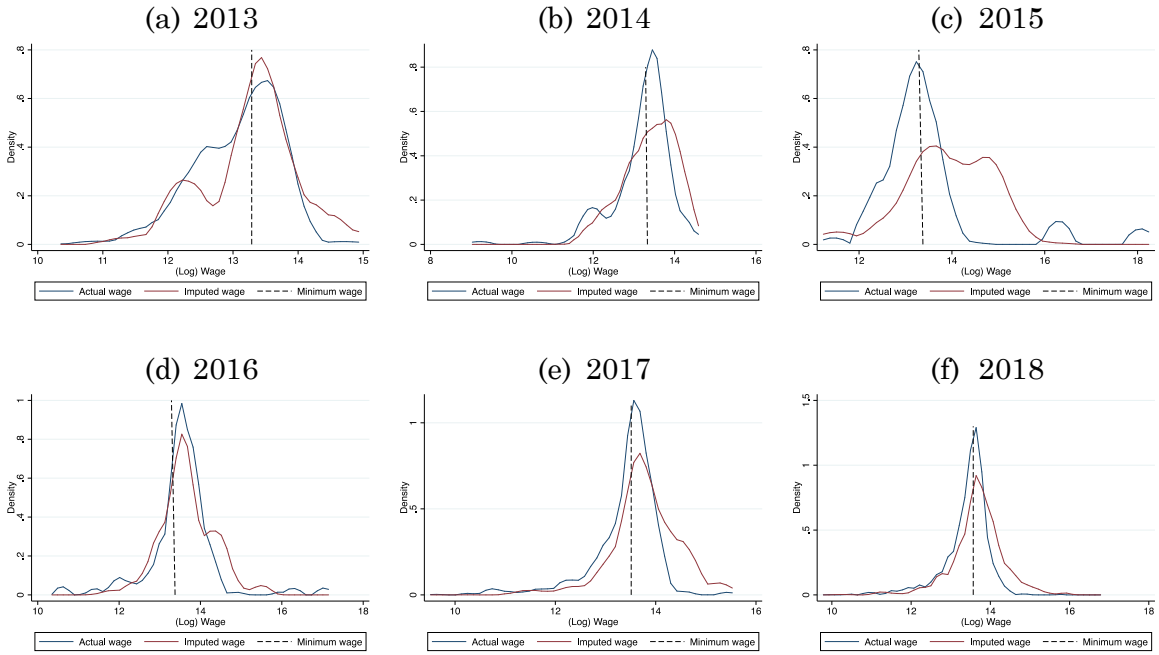
Panel *(c)*: revenues/expenditures ratio, relative to permanent natives

	Average Effect	*Marginal Effect*		*Average Effect*	*Marginal Effect*
Armenia	1.050	1.455	Neiva†	0.967	1.170
Barranquilla	0.796	0.935	Pasto†	1.042	1.833
Bogotá	0.493	0.513	Pereira	0.894	1.190
Bucaramanga	0.775	0.939	Popayán†	0.860	0.932
Cali	0.742	1.271	Quibdó†	1.429	1.769
Cartagena	0.879	1.144	Riohacha	1.726	1.880
Cúcuta	0.866	2.247	Santa Marta	0.768	0.935
Florencia†	–	–	Sincelejo	0.927	1.059
Ibagué†	0.967	1.258	Tunja	0.654	0.907
Manizales	0.806	1.047	Valledupar	1.003	1.227
Medellín	0.696	0.658	Villavicencio	0.747	0.980
Montería	1.313	1.585			

Notes. The Table reports the net fiscal impact for Venezuelan immigrants (native returnees and Venezuelan-born) at the local level averaged over fiscal years 2013–2018. Panel *(a)* reports the average per capita net fiscal contribution, expressed in 2018 equivalent Colombian pesos. Panel *(b)* reports the ratio of revenues contributed to expenditures received in real terms. Panel *(c)* reports the revenues/expenditures ratio for Venezuelan-born immigrants relative to natives. We use gross domestic product implicit price deflator for each regional jurisdiction (Department) to estimate equivalent COP. Estimates are averaged over years with a minimum sample size as describe in the text. † Caution should be taken when interpreting the local-level estimates because of small immigrant population and subsample size.

Figure A1

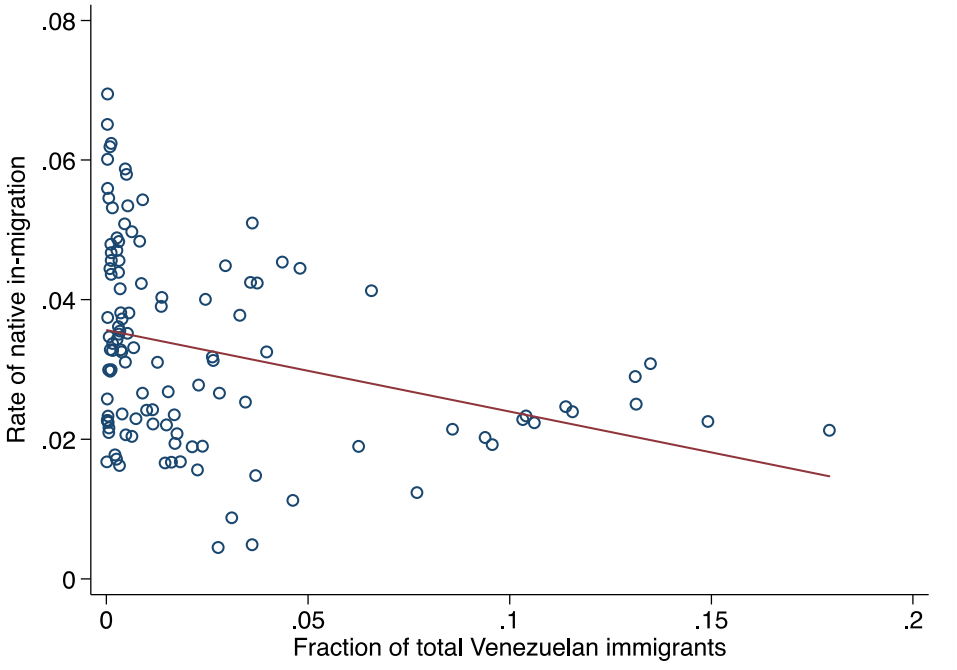
Wage distribution of Venezuelan-born informal wage workers



Notes: The figure plots the (log) wage distribution for Venezuelan-born informal wage workers in each sampled year. Informal workers are those that do not report payments to both the pension and health system. Imputed wages are based on a Predictive Mean Matching algorithm.

Figure A2

Migration rates for natives and Venezuelan immigrants



Notes: The figure plots the annual migrant flows divided by the native-born population in the previous period against the fraction of Venezuelan immigrants living in each municipality.

B. Allocation of Revenues and Expenditures

In this section we explain the technical details and data sources used to construct the apportioning coefficients for allocating tax receipts and government expenditures outlined in Section 3.3 of the paper.

B.1. Revenues

(1) Income tax, social insurance and payroll taxes. We use the income information reported in the GEIH to estimate each group's share of total payments. We use labor income for wage and salary workers and for self-employed and apply social insurance and payroll tax rates. To compute income tax we use taxable income, which also includes additional sources of income (*e.g.,* capital income). Our estimates include both the income tax for those individuals above the income threshold in each year and an estimate of tax withholdings for those not obliged to fil a tax return.[1]

To estimate income tax, we apply year-specific tax rates of the ordinary system to gross annualized taxable income. We use information from all sources of wage and capital income, non-labor compensation, the sale of fixed assets, and all payments for fees, commissions, services, emoluments and others, reported in the GEIH. We aggregate monthly wages into annual earnings and include information on self-employment income. Until 2017 income tax could be estimated using one of three regimes for workers classified as 'employees': the ordinary system, the National Alternative Minimum Tax (IMAN) and the Alternative Minimum Simple Tax (IMAS), the latter was optional depending on the level of income or wealth. Although the tax each person had to pay was the highest value resulting from simultaneously declaring via the ordinary system and IMAN, we use the ordinary system for simplicity. This does not compromise the results. In our estimates we allow for tax benefits that reduce the tax base. These benefits are classified into three main categories: (i) costs and deductions (*e.g.* health, education, mortgage interests), (ii) non-taxed income (*e.g.* dividends, pension contributions), and (iii) exempt income (*e.g.* 25% of income, worker's compensation). For self-employed we deduct automatically 50% of income. Now, Colombia has a standard "pay as you earn" system for wage and salary workers where estimated taxes are collected throughout the year in the form of

[1] It is important to include withholdings for two reasons: 1) even if a person is not obliged to file a tax return, withholdings make him or her a taxpayer; 2) according to Steiner and Cañas (2014), in 2010 76% of those who paid income taxes did so in the form of withholdings even without having filed a tax return, this is about 3.5 million people of the 4.6 million who contributed.

withholdings and then the total tax obligation is adjusted against the next tax return. This system also covers most self-employed workers that receive honorariums or are contractors. According to data from Colombia's Tax Administration (*Dirección de Impuestos y Aduanas Nacionales—DIAN*) in 2018 withholdings accounted for almost 75% of total revenues from personal income tax. Since our data does not follow individuals over time, we use income in year t to compute shares to allocate tax receipts in year t. In addition, for 2017 and 2018 we treat dividends as part of capital tax schedule as we cannot separately identify this in the GEIH.

For social insurance contributions we use the information provided in the GEIH on everyone affiliated—and contributing—to either a public or private pension fund and those affiliated to the contributory health care regime. We then apply the appropriate year-specific rates to the estimated Contribution Base Income.[2] For payroll taxes we apply year-specific rates for all wage and salary workers. For each fiscal year, we can then compute the total payments of income tax, social security contributions and payroll taxes, and estimate each group's share. We exclude social security contributions from official teachers, as they are included as part of the National Teachers Pension Fund (*Fondo Nacional de Prestaciones Sociales del Magisterio, FOMAG*). In addition, we allocate social security contributions to other special regimes, such as police and the national railway fund, using reported affiliation in the GEIH and excluding workers in the educational sector (pre-school, primary or secondary education) classified as wage and salary workers working for the government. On average, between 2013 and 2014 these special funds accounted for 3.5% of total social security contributions.

(2) Corporate and capital taxes. We apportion corporate taxes by first deducting the share of nonresident foreign ownership. To deduct the share of foreign ownership we use information from the *Unified Commercial and Social Registry (RUES)* which collects data for all registered business in Colombia and their share of local and foreign capital. These shares ranged between 8% and 17% in the fiscal years considered. Individual shares for each company were weighted by their total assets. Next, we distribute the remaining corporate taxes using each group's share in the population receiving individual dividend and interest income and allocate the national public ownership share to natives on a

[2] We impute employers' share of social security contributions to the employee. Health contributions paid by employers are 8.5% for employees who earn 10 times the monthly minimum wage, or more. Pension contributions paid by employers are 12% of the monthly wage.

pro rata basis.[3] In order to achieve sufficient sample size for our analysis in this case, our estimates are based on rolling 2-year GEIH samples, except for 2013. For example, the proportion of each group receiving dividend and interest income for 2018 come from pooled GEIH samples for 2017-2018. Public ownership ranges between 2% and 13% for the years included in the analysis. As part of our sensitivity analysis, we allocate corporate taxes using the share of individual investment income of long-term residents (>5 years), net of nonresident foreign ownership share. The information in the GEIH on individual dividend and interest income includes income from interest on loans or CDs, savings deposits, profits, gains or dividends on investments. We don't include this as our baseline scenario because the information reported by households extends beyond business profits or dividends on investment, and thus it is likely to be capturing interests from direct lending to other households.

(3) Wealth tax. The wealth tax is levied on taxable net worth of both individuals and firms.[4] Between 2011 and 2014 Colombia had in place a one-off wealth tax for individuals and firms with a reported net worth exceeding $1 billion COP and average tax rates ranging from 1% to 6%. The one-off tax was to be made in up to eight equal payments between 2011 and 2014. Now, between 2015 and 2018 individuals with a reported net worth exceeding $1 billion COP were charged marginal tax rates ranging between 0.125% and 1.5%. In addition, firms with equity exceeding $1 billion COP experienced tax rates of 1.15% for 2015, 1% for 2016, and 0.4% for 2017, prior to the abandonment of the tax for 2018. Thus, between 2013 and 2017 we allocate revenues to tax payments from both firms and individuals, and for 2018 we allocate revenues solely for tax payments by individuals. To distribute the wealth tax revenues between individuals and firms we use estimates from Londoño-Vélez and Ávila-Mahecha (2018). According to their estimates, for 2011-2014 corporations accounted for 94% of total wealth tax revenues. For 2015-2017 we use their estimates of personal wealth tax revenues as share of GDP depicted in Figure A.1. in their paper and distribute any remaining payments in 2018 using the share in 2017. We treat firms' wealth tax payments similarly to corporate and capital tax payments. In the case of personal wealth tax payments, we use a multi-step procedure to proxy for asset ownership based on information from the GEIH. First, we take self-reported values on the minimum price a household would sell

[3] In Section 6, when we allocate corporate and capital taxes at the local level, we use each group's share in the adult (18+) population and allocate the national public ownership share to natives on a *pro rata* basis. We do this because the frequency of observations for dividend and interest income drops significantly.

[4] We include both *patrimonio* and *riqueza* as they have the same purpose and tax the same source, net wealth.

their house if they decided to do so and distribute the resulting value among the head of household and his or her spouse/partner. Next, we estimate price-to-rent ratios for each year using expected rent and expected dwelling values and apply these ratios to annualized individual rental income (*e.g.* houses, apartments, rural property). Finally, we sum all individual property values and allocate revenues based on each group's share among total assets in the 90th percentile.[5]

(4) VAT and other indirect taxes. We estimate each group's share of total payments for each tax, net of nonresident direct purchases share, following the common multi-step procedure in the literature. First, we apply decile-specific effective tax rates to households' gross income from the GEIH depending on the position in the income distribution. We include as part of the household only the expenditure unit. In other words, we exclude domestic workers, their children, and those living as a roomer in a private home or lodging house. The expenditure unit is usually the core of all consumption decisions within a household. All other members of the household that are not part of the expenditure unit are considered as an expenditure unit in its own. Decile-specific effective tax rates are based on our own estimates using the 2014 Quality of Life Survey (*Encuesta de Calidad de Vida—ECV*) and the 2016-2017 Household Income and Expenditure Survey (*Encuesta Nacional de Presupuestos de los Hogares—ENPH*). A detailed account of how we proceed to estimate the incidence of indirect taxes, tariffs and import duties is presented in the Online Appendix. This allows us to estimate the total spending of the household from eight types of expenditure grouping a little more than 100 categories of items or services that make up the main expenditures: food, early childhood and education, health, clothing expenses and footwear, services and equipment for housing, culture and recreation, transportation and communications, and other household expenses. We apply the tax structure in place in 2014, 2016 and 2017. We use effective tax rates in the following way: (i) for 2013-2014 we use 2014 effective tax rates; (ii) for 2015-2016 we use 2016 effective tax rates; (iii) for 2017-2018 we use 2017 effective tax rates. Then we distribute each household's total payments in indirect taxes to all members of the household using individual contributions to the household gross income. Finally, we compute apportioning coefficients for each indirect tax by summing total payments for the projected population using sample weights and estimating the contribution of each sub-population group (as defined in Section 3) in total payments. We use the

[5] Londoño-Vélez and Ávila-Mahecha (2018) note that the wealth tax cutoff excludes more than 99% of adults.

information from DANE's macroeconomic aggregates to exclude final consumption spending by non-resident households in the economic territory.

A limitation of expenditure surveys is the lack of an identifier for the country of origin, which does not allow us to separately identify consumption patterns for natives and immigrants. In this sense, the implicit assumption is that natives and immigrants with similar levels of income have similar consumption patterns. While Colombia and Venezuela share cultural traits, and one would expect this not to be a significant issue, immigrants may have lower consumption, particularly recent migrants, or send remittances back to their home countries at levels that may affect consumption. In our sensitivity analysis we follow the literature and assume a 20% reduction in total payment of indirect taxes paid by immigrants relative to the average for the general population.

Now, since firms contribute to nondeductible VAT, tariffs and import duties revenues, we use data from the supply and use tables of the National Accounts System to estimate the share of payments attributed to firms. We treat firms' nondeductible VAT, tariffs and import duties payments similarly to corporate and capital taxes payments. Wine and spirits VAT revenues are assigned to households.

(5) Motor vehicle tax. We apportion motor vehicle tax proportionately to the share of motor vehicle ownership (car or motorcycle) for each group in the adult (18+) population. Since we can only identify ownership at the household level in the GEIH we assume equal contributions from all adult members.

(6) Property tax. The property tax is levied on all real estate by local authorities. The taxable base of the property tax for each year corresponds to the value reported by the taxpayer through a self-assessment, which must be at least the cadastral value. According to estimates from Ávila-Mahecha (2015), firms contributed on average 70% to total property tax revenue between 2010-2013. We use this share to allocate total payments between firms and individuals for all years. We treat firms' contributions similarly to corporate and capital taxes payments and treat households' revenues similarly to personal wealth tax payments, but instead of using only those asset values in the 90^{th} percentile we use in this case the whole distribution.

(7) Industry and commerce tax. The industry and commerce tax is caused by direct or indirect industrial, commercial or service activities in the jurisdiction of a specific municipality. According to estimates from Ávila-Mahecha (2015), firms contributed on average 90% to total industry and commerce tax revenue between 2010-2013. We use this share to allocate total payments between firms and self-employed for all years. We treat firms' contributions similarly to corporate and capital taxes payments and allocate

households' revenues using the share of self-employed owning an industrial, commercial, or service business.

(8) Financial transactions tax. This indirect tax is applied to different types of financial transactions carried out by users. According to estimates from Ávila-Mahecha (2015), firms contributed roughly 85% to total payments of financial transactions tax in 2013. We use this share to allocate total payments between firms and households for all years. Since we don't have access to information about the access of households to financial services, an neither do we have on the legal status of immigrants, we cannot identify those individuals who have or may have "potential" access to a financial service. Nonetheless, using our estimates from the ENPH on the expenditures-to-income ratio by decile (see Online Appendix) we estimate each person's expenditures using the total income reported in the GEIH. We then allocate financial transactions tax using the share of each group's expenditure among those with monthly expenditures above 350 units of tax value (UVT for its Spanish acronym)—which is defined each year by the government. This threshold, set by law, determines the amount on which the tax exemption applies to financial movements for checking or savings accounts. Now, we are implicitly assuming that natives and immigrants above the threshold have similar access to financial services. While we know immigrants face difficulties to access the financial system as it may take time for them to have all the required documents, we have no way of addressing this. Finally, we treat firms' contributions similarly to corporate and capital taxes payments.

(9) Gross operating surplus, rents and royalties. In our *average effect* scenario, we apportion government's capital income (gross operating surplus, dividends, interests, royalties and pension funds savings surplus) proportionately to the share of each group in the adult (18+) population. Now, in the *marginal effect* scenario, we attribute all revenues to the native-born population. As is standard in the literature, we implicitly assume these resources are the result of managerial or investment decisions that took place before immigrants' arrival.

(10) *Urban phones tax*. To apportion urban phones tax payments, we use the share of adult population (18+) with access to a landline.

(13) *Educational services*. We group revenues of all official universities, net of government transfers, under educational services. We apportion these receipts using the share of each group in the total population enrolled in higher education in public institutions.

(12) *National Teachers Pension Fund*. The teachers' fund is responsible, among other activities, for making the payment of social benefits (layoffs,

pensions, among others) and guaranteeing the provision of medical assistance services to teachers—and their beneficiaries—in the public sector. The fund is composed of employer contributions, teacher contributions and additional contributions from the National Government. We exclude the latter as these transfers are already included in the overall revenues of the Central Government. We allocate these resources using the share of each group in the total number of workers in the educational sector (pre-school, primary or secondary education) classified as wage and salary workers working for the government.

(13) Immigration certificates. We allocate receipts from the issuance of foreign resident identification cards using each group's share in the foreign-born population.

(14) Other. All remaining tax payments, fees, fines and penalties, and other receipts, are apportioned according to the share of each group in the adult (18+) population. We exclude receipts from credit operations.

B.2. Expenditures

(1) 'Pure' public goods. We include in this group all expenditures associated with public goods or services that are normally considered as non-rival in consumption—excluding debt servicing. In our *average effect* scenario, we apportion public goods proportionately to the share of each group in the population. Now, in the *marginal effect* scenario, we attribute all costs to the native-born population.

(2) 'Congestible' public goods. We include in this group all expenditures that are to some extent rival in consumption. We apportion the cost of providing these goods according to each group's share in total population (*average effect*).

(3) Law courts and prisons. We consider the expenditure in law courts and prisons as a 'congestible' public good and apportion them proportional to the number of recipients. We use information on the nationality of prison inmates from the National Penitentiary and Prison Institute, INPEC,[6] and apportion law courts and prison costs proportionately to the size of each group in the prison population. In this case we classify immigrants based on the reported nationality which need not be consistent with the country of birth. We distribute the total Venezuelan-born inmate population among cohorts using the share of each cohort. We do the same between permanent natives and returnees.

[6] INPEC is the Colombian central government agency responsible for the administration of the penitentiary institutions in the country.

(4) Water supply. Water supply comprises of expenditures for the administration, construction or operation of water supply systems other than those provided by companies. We estimate each group's share of the total population with access to water supply as reported in the GEIH.

(5) Health services. To estimate each group's share of health services expenditure we use the distribution of health costs by age group and the affiliation status to the General Health Care Social Security System (SGSSS) as reported in the GEIH. Now, while access to the SGSSS benefits' plan is conditional on being affiliated to either the contributory or subsidized regime,[7] by law, emergency services must continue to be provided to those not affiliated. In line with this, we distribute total health expenditures between affiliates and non-affiliates using the average theoretical value of the capitation payment unit (UPC),[8] which is fixed each year by resolution (similar to an executive order). We follow Reina *et al.* (2018) and assign the complete value of the UPC to those affiliated and 45% of the UPC for the subsidized regime as the cost of health services for those not affiliated. Next, we estimate the distribution of health costs by age group using the number of equivalent affiliates and the UPC value in each age group for each health regime as published by the Ministry of Health.[9] Then, we apply the contribution of each age group to total health expenditures according to their affiliation status and distribute the resulting values proportionately to the share of immigrants and natives in each age range. As we lack information on the use of health services between immigrants and natives, we assume that both groups have similar service use patterns.

(6) Education. Expenditures for education include expenditure for compulsory education, job training programs and higher education. We use GEIH information on school or program participation for the different levels by combining information on enrollment and educational attainment, and compute for each group the share among the total participants on each level. In particular, for compulsory education we apportion expenditures using direct information from the GEIH on the share of each group in the population between 3 and 16 years of age that attends pre-school, primary or secondary education in official

[7] We treat those that report being affiliated to special regime (military, police, teachers, etc.) as part of the contributory regime.

[8] The UPC is the annual amount recognized by the national government for each individual affiliated to the General Health Care Social Security System (SGSSS) to cover the health benefits plan in the contributory and subsidized regimes.

[9] Equivalent affiliates are an estimate of the number of people who were affiliated 360 days a year. Each year the Ministry of Health publishes a technical study to determine the sufficiency of the Capitation Payment Unit (UPC) of the contributory and subsidized regimes to finance the services contained in each benefit plan. These studies are available for consultation at: https://www.minsalud.gov.co/salud/POS/Paginas/unidad-de-pago-por-capitacion-upc.aspx

establishments in the *average effect* scenario. In our expenditures data we cannot discriminate between levels of compulsory education, so we simply assume that the average cost is the same across school levels.[10] Now, spending in compulsory education includes all expenditures associated with the provision of education and those related to the administration, inspection, management or support of schools and other institutions that provide pre-school, primary or secondary education. This does not include the spending on the construction of new schools, transport subsidies or school feeding programs, which we include as part of 'congestible' goods. Spending on compulsory education is carried out by local authorities using transfers from the National Government through the General Participation System (SGP) which are essentially distributed according to payroll costs. Thus, it is likely—at least in the short-term—that the marginal cost of educating an immigrant child is just a fraction of the average cost. So, given the high inflexibility of the teaching staff in the short-term, in the *marginal effect* scenario, we attribute costs for all children between 3 and 16 years of age attending compulsory education in official establishments in the following way: (i) all immigrants and native-born returnees residing in the country for less than a year are assign a marginal cost of zero; (ii) everyone else is assign the average cost.

Expenditures for job training are allocated using the share of each group in the total population that at the time of the survey was attending a job training program. We use the share of each group in the total population attending only job training programs in public institutions as part of our sensitivity analysis. We don't include this as our baseline scenario because the Colombian government also finances with public resources the private provision of job training through public-private programs such as *Jóvenes en Acción*, or direct subsidies and loans to students. Finally, for higher education expenditures, we compute the share of each group in the college population in public institutions.

(7) Social protection. Provision of social protection is provided in the form of cash and in-kind benefits and comprises expenditures for sickness and disability spending, pension benefits, family and children, unemployment benefits, social housing and vulnerable population. Using the information of self-declared benefit recipients from the GEIH, we estimate the share of each group receiving the relevant benefit. Specifically, we use the information in section M of the GEIH to identify beneficiaries. Now, from 2013 to 2015 the questionnaire does not disaggregate by type of benefit, so we only have information on overall

[10] Using data for 2017 from the Ministry of Education on the average cost per student that must be allocated to finance the provision of education, we don't see large differences in the average costs by level.

cash benefits from government agencies. We use this information to allocate all expenditures for family and children and social housing for fiscal years 2013 to 2015. For fiscal years 2016 to 2018 we use the following criteria: for pension benefits we use pension income received from the government including *Colombia Mayor*, for family and children benefits we use the conditional cash transfers program *Más Familias en Acción*, and for social housing we use everyone reporting being a recipient of housing-related subsidies (social housing, interest rate subsidy, eviction subsidy, subsidy for victims of natural disaster or displacement, municipality subsidy, etc.). This information includes the amount of income received by individual members of the household with at least 10 years of age during the last month or the last year for each type of benefit claimed by welfare claimants. Now, since the amount of family and children benefits depends on the number of children, in our sensitivity analysis we use as an alternative allocation the share of dependent children among family-related benefits recipients.

In the case of sickness and disability, unemployment benefits and vulnerable population, because we have no information on the amount of benefits received, we assume recipient receive the same quantity. We use the share of the inactive population that left their last job within a year due to illness or accident to allocate sickness and disability spending. To allocate unemployment benefits we use the share of each group in the total beneficiary population. Finally, we apportion expenditures for vulnerable population using the proportion of each group in total population classified as either immigrant or native-born returnee arriving during the last twelve months, internally displaced from armed conflict, violence, natural disasters or associated to an ethnic group, or receiving cash benefits from the government with the purpose of reducing their poverty level.

(8) Debt service. As we discussed in Section 2, payment of interest on the national debt should also be attributed to migrants. Particularly, interests for debt acquired as a result of their arrival to the country, not the one incurred before their arrival. Therefore, we obtain information from the Ministry of Finance to desegregate the debt service for the National government in each fiscal year by the year the debt was issued. Next, we group interest payments using immigrant's cohort classification: (i) less than a year, (ii) one to five years, (iii) more than five years.[11] Then, we apportion debt service expenditures proportionately to the share of each group in the total resident population by year of arrival. Note that this will allow us to also apportion expenditures

[11] For example, the total debt service for 2018 is classified in the following way: (i) debt issued in 2017, (ii) debt issued between 2012-2016, (iii) debt issued before 2012.

differently between permanent natives and the native-born population that returned from Venezuela. Debt service of regional and local governments is allocated on a *pro rata* basis as we don't have detailed information to disaggregate it further.

Table B1
List of Government Revenues

Revenue source	Grouping
Personal income tax Withholding tax Capital gains taxes Social security contributions Payroll taxes	Income tax, social insurance and payroll taxes
Corporate income tax Minimum presumptive tax Income tax for equality (CREE)	Corporate and capital taxes
Wealth tax	Wealth tax
Value-added tax Consumption tax Wine and spirits duties Beer and cider duties Tobacco duties Carbon tax Fuel tax Fuel surcharge Tariffs and customs duties	VAT and other indirect taxes
Vehicle excise duties	Motor vehicle tax
Property tax	Property tax
Industry and commerce tax	Industry and commerce tax
Financial transactions tax	Financial transactions tax
Gross operating surplus and rents Interests and dividends Oil and mining royalties	Gross operating surplus, rents and royalties
Urban phones tax	Urban phones tax
Educational services	Educational services
Social security contributions FOMAG Other receipts FOMAG	National Teachers Pension Fund
Foreign resident identification card	Immigration certificates
Fees and rights Fines and penalties Contributions Sale of goods and services	Other

Contractual income	
Other taxes	
Other receipts	

Note. The Table reports the list of government revenues we assembled based on information from the Ministry of Finance, DIAN, FUT, SGR, and the General Accounting Office, and the classification we use in our analysis to group them.

Table B2

List of Government Expenditures by Sub-Function (UN COFOG-DANE)

Expenditure item		Grouping
1.1 - 1.2	Executive and legislative organs, financial and fiscal affairs, external affairs, and foreign economic aid	'Pure' public goods
1.3	General services	
1.4	Basic research	
1.5	R&D general public administration	
1.6	General public administration n.e.c.	
1.8	Transfers of a general character between different levels of government	
2.1	Military defense	
2.2	Civil defense	
2.3	Foreign military aid	
2.4	R&D defense	
2.5	Defense administration	
3.1	Police services	'Congestible' public goods
3.2	Fire-protection services	
3.5	R&D public order and safety	
3.6	Public order and safety administration	
4.1	General economic, commercial and labor affairs	
4.2	Agriculture, forestry, fishing and hunting	
4.3	Fuel and energy	
4.4	Mining, manufacturing and construction	
4.5	Transport	
4.6	Communication	
4.7	Other industries	
4.8	R&D economic affairs	
4.9	Economic affairs n.e.c.	
5.1	Waste management	
5.2	Wastewater management	
5.3	Pollution abatement	
5.4	Protection of biodiversity and landscape	
5.5	R&D environmental protection	
5.6	Environmental protection administration	
6.1	Housing development	
6.2	Community development	
6.4	Street lighting	
6.5	R&D housing and community amenities	
6.6	Housing and community amenities administration	
7.5	R&D health	
7.6	Health administration	
8.1	Recreational and sporting services	
8.2	Cultural services	

8.3	Broadcasting and publishing services	
8.4	Religious and other community services	
8.5	R&D recreation, culture and religion	
8.6	Recreation, culture and religion administration	
9.5	Education not definable by level	
9.6	Subsidiary services to education	
9.7	R&D education	
9.8	Education administration	
10.8	R&D social protection	
10.9	Social protection administration	
3.3	Law courts	Law courts and prisons
3.4	Prisons	
6.3	Water supply	Water supply
7.1 - 7.2 - 7.3	Medical, hospital and pharmaceutical services	Health services
7.4	Public health services	
9.1 - 9.2	Pre-primary, primary and secondary education	Education: compulsory education
9.3	Post-secondary non-tertiary education	Education: job training
9.4	Tertiary education	Education: higher education
10.1	Sickness and disability	Social protection: sickness and disability
10.2 - 10.3	Old age	Social protection: pensions
10.4	Family and children	Social protection: family and children
10.5	Unemployment	Social protection: unemployment
10.6	Housing	Social protection: housing
10.7	Socially vulnerable and excluded population	Social protection: vulnerable population
11	Public debt service	Debt service

Note. The Table reports the list of government expenditures by sub-function (UN COFOG) as adopted by Colombia's Statistical Department (DANE) and the classification we use in our analysis to group them.

C. Incidence of indirect taxes, tariffs, and import duties

This section details our estimates of the incidence of indirect taxes, tariffs, and import duties on households' income and expenditure.

C.1. Unit of analysis

We use as the unit of analysis the expenditure unit of the household. We thus make a distinction between the members of the household and the expenditure unit. The expenditure unit considers all members of a particular household who are related by blood, marriage, adoption, or other legal arrangements. In other words, the expenditure unit excludes domestic workers, their children, and those living as a roomer in a private home or lodging house. The expenditure unit is usually the core of all consumption decisions within a household. We will refer to the unit of analysis interchangeably as the expenditure unit or household.

C.2. Data and additional sources of information

To estimate the incidence of indirect taxes, tariffs, and import duties between 2013 and 2018 on the income and expenditure of households, we used the 2014 Quality of Life Survey (*Encuesta de Calidad de Vida—ECV*) and the 2016-2017 Household Income and Expenditure Survey (*Encuesta Nacional de Presupuestos de los Hogares—ENPH*) carried out by Colombia's National Department of Statistics (DANE). These surveys consist of a sample of over 20,000 households and 67,000 nationally representative individuals. A limitation of both surveys is the lack of an identifier for the country of origin, which does not allow us to separately identify consumption patterns for natives and immigrants. Therefore, we assume both groups have similar consumption decisions. Considering that Colombia and Venezuela share cultural traits, this does not strongly weaken our assumption.

We estimate the total spending of each household from eight expenditure groups combining over 100 spending items: food, early childhood and education, health, clothing expenses and footwear, services and equipment for housing, culture and recreation, transportation and communications, and other household expenses. We apply the tax structure in place in 2014, 2016, and 2017. Since at the end of 2016 the Congress approved changes to the tax system, particularly changes to indirect taxes, we split the ENPH sample according to the year each household was surveyed. Roughly this splits the sample 50/50. We

distribute households by income deciles using the annualized information. In addition, we use the information from the Supply and Use tables reported by DANE in the National Accounts System to estimate the incidence of tariffs and import duties.

C.3. Methodological approach to the incidence of taxes, tariffs, and import duties

We can estimate the total expenditure of the household by using the following equations:[12]

1. $$Consumption_{hi} = \frac{Expenditure_{hi}}{(1 + \tau_i)},$$

2. $$EIT_{hi} = Expenditure_{hi} - Consumption_{hi},$$

3. $$EIT_h = \sum_{i \in \mathcal{I}} EIT_{hi},$$

where,

- $Expenditure_{hi}$: Household expenditure level (h) for each of the goods (i).
- $Consumption_{hi}$: Household expenditure level (h) for each of the goods (i) after deducting indirect taxes.
- τ_i: Tax rate with which the consumption of each good (i) is taxed.
- EIT_{hi}: Expenditure of the household (h) on indirect taxes on each of the goods (i).
- EIT_h: Total expenditure of the household (h) on indirect taxes.

We estimate the effective tax rate (ETR), defined as the proportion of the total income—or expenditure—of the expenditure unit (TIEU) used to pay indirect taxes, tariffs, or import duties, as follow:

4. $$ETR_h = \frac{EIT_h}{TIEU_h}$$

The total income of the expenditure unit is used to distribute households by deciles. The TIEU corresponds to the sum of current income (monetary and

[12] This follows broadly the work of Steiner and Cañas (2014).

non-monetary) including income received by children under 12 years of age, transfers (from entities or households), benefits and other current income, the imputation of the estimated rent for homeowners, de facto occupants of a dwelling or in usufruct, and occasional monetary income. On the expenses side, we use the sum of the current and occasional expenses of the household (monetary and non-monetary), including the personal expenses of each of its members, but excluding the expenses of domestic workers, their children, and those living as a roomer in a private home or lodging house. Additional exercises including self-consumption and self-supply as part of income and expenses were carried out but are not presented here.

To estimate the incidence of tariffs and import duties for each expenditure group we use the information on total revenues from tariffs and import duties, the value of imported goods and services—including tariffs and import duties, and the value of total supply after mark-ups, taxes, and subsidies. We then compute the share of tariffs and import duties in the final value of imported goods and services, and the share of imported goods in the total supply. We then apply these shares to the total spending of the household.

C.4. Adjustments for inconsistencies in the reporting of information

We make the following adjustments to the sample as a way to correct possible biases generated by extreme or atypical values in the information reported in the surveys: (1) for all observations with income equal to zero and expenses greater than zero, the value of the expenditure variable was imputed as income; (2) the sample is restricted to those observations for which its distance from the third quartile, as a proportion of the interquartile range, is less than three;[13] (3) observations with an income lower than ¼ of the monthly minimum wage are excluded [see Ramírez and Molina (2003)]. By doing so we expect to reduce the information bias caused by households that report very low income that does not fit the household consumption pattern. (4) Finally, households with an expenditure-to-income ratio greater than 2.5 are excluded in order to avoid the overestimation of spending for the payment of indirect taxes, thus avoiding the presence of consumption levels that are not achievable with the reported income level.

[13] Although this rule is more restrictive and significantly reduces the income 'cap', the results for the highest deciles do not show a significant variation. In any case, this does not affect the analysis.

Table C1

Household monthly income and expenditure by income decile, including self-consumption and self-supply

Income decile	Number of households			Mean income of the household			Mean expenditure of the household			Expenditures/Income Ratio		
	2014	*2016*	*2017*	*2014*	*2016*	*2017*	*2014*	*2016*	*2017*	*2014*	*2016*	*2017*
1	1,290,535	1,326,290	1,363,078	366,366	619,030	631,606	498,575	842,681	854,485	1.36	1.36	1.35
2	1,257,551	1,326,858	1,412,415	610,566	926,406	922,142	764,662	1,079,394	1,068,993	1.25	1.17	1.16
3	1,240,650	1,326,620	1,314,310	789,433	1,111,353	1,165,713	913,745	1,175,447	1,214,861	1.16	1.06	1.04
4	1,262,738	1,337,571	1,388,202	971,850	1,356,355	1,366,724	1,069,454	1,306,476	1,335,077	1.10	0.96	0.98
5	1,264,014	1,360,313	1,337,324	1,189,968	1,598,572	1,606,057	1,199,923	1,435,857	1,463,946	1.01	0.90	0.91
6	1,262,013	1,279,957	1,361,960	1,463,835	1,894,319	1,898,333	1,364,199	1,604,425	1,626,414	0.93	0.85	0.86
7	1,263,756	1,326,348	1,382,746	1,826,395	2,159,337	2,175,143	1,629,991	1,711,710	1,766,374	0.89	0.79	0.81
8	1,262,402	1,325,726	1,342,984	2,376,830	2,520,218	2,637,979	1,967,250	1,891,348	1,991,666	0.83	0.75	0.75
9	1,262,269	1,339,146	1,370,390	3,350,499	3,332,854	3,565,383	2,568,828	2,274,601	2,504,331	0.77	0.68	0.70
10	1,262,684	1,313,271	1,355,319	7,974,389	6,779,020	7,189,811	5,620,368	3,578,479	4,208,419	0.70	0.53	0.59
Total	12,628,613	13,262,100	13,628,727	2,090,946	2,356,424	2,348,627	1,758,716	1,750,468	1,824,547	0.84	0.74	0.78

Source. Authors' calculations using data from the 2014 ECV and 2016-2017 ENPH.

Table C2

Household monthly income and expenditure by income decile

Income decile	Number of households			Mean income of the household			Mean expenditure of the household			Expenditures/Income Ratio		
	2014	*2016*	*2017*	*2014*	*2016*	*2017*	*2014*	*2016*	*2017*	*2014*	*2016*	*2017*
1	1,265,532	1,326,290	1,363,078	325,000	536,406	551,064	453,631	777,076	792,990	1.40	1.45	1.44
2	1,265,309	1,326,858	1,412,415	571,551	853,836	865,937	715,785	1,005,021	1,009,866	1.25	1.18	1.17
3	1,259,144	1,326,620	1,314,310	757,115	1,059,802	1,088,293	885,924	1,119,774	1,144,307	1.17	1.06	1.05
4	1,262,212	1,337,571	1,388,202	939,718	1,325,763	1,331,800	1,041,606	1,259,583	1,281,210	1.11	0.95	0.96
5	1,262,628	1,360,313	1,337,324	1,158,949	1,546,377	1,560,237	1,148,570	1,363,310	1,403,395	0.99	0.88	0.90
6	1,272,442	1,279,957	1,361,960	1,440,562	1,830,740	1,814,569	1,367,366	1,529,713	1,539,092	0.95	0.84	0.85
7	1,252,824	1,326,348	1,382,746	1,802,306	2,075,798	2,167,908	1,612,715	1,639,133	1,728,733	0.89	0.79	0.80
8	1,265,938	1,325,726	1,342,984	2,348,684	2,514,574	2,564,658	1,945,261	1,839,194	1,901,179	0.83	0.73	0.74
9	1,259,790	1,339,146	1,370,390	3,324,309	3,321,237	3,520,593	2,527,952	2,220,453	2,415,530	0.76	0.67	0.69
10	1,262,795	1,313,271	1,355,319	7,936,389	6,748,541	7,161,976	5,581,321	3,497,135	4,098,913	0.70	0.52	0.57
Total	12,628,613	13,262,100	13,628,727	2,059,728	2,315,583	2,299,887	1,727,497	1,688,296	1,754,419	0.84	0.73	0.76

Source. Authors' calculations using data from the 2014 ECV and 2016-2017 ENPH.

Table C1 shows the average monthly income and expenditure of the household in each income decile for the years 2014, 2016 and 2017. The average monthly income of the household in decile 10 went from under 22 times that of the first decile in 2014 to over 11 by 2017. Now, these relationships are cut in half when looking at average expenditures. On the other side, the expenditures/income ratio per decile decreases as the average income increases, going from around 1.36 pesos spent for each peso of income for the first decile to about 0.5-0.70 pesos spent for each peso of income in the last decile. It is interesting that around half of the households the expenditures/income ratio is greater than 1 in 2014, that is, their total expenses exceed their total income. However, this relationship is slightly reduced when self-consumption and self-supply are excluded (Table C2) and declined for almost all deciles except the first one during 2016-2017.

C.5. Results

Only the results excluding self-consumption and self-supply in income and expenditures are presented below. We don't present the results including self-consumption and self-supply because this information is not available in our main data set used in the paper: the GEIH.

Indirect taxes

Tables C3 to C5 show the aggregate incidence of indirect taxes as a proportion of household's income and expenditure by income decile, using different definitions of income. The results indicate that while high-income households spent more of their expenditures on indirect taxes, as a proportion of their income, the burden of indirect taxes is lower. On average the incidence of indirect taxes on both incomes and expenditures of households increased over the years. While the latter is consistent with changes in the tax structure, this suggest that household's income and expenditures have increase at a slower pace. The incidence of indirect taxes for the different measures of income and expenditure ranges from 5.0% to 6.7%, on average. In addition, our estimates show that the changes in tax rates from 2014 to 2017 affected more heavily lower-income households.

Table C3

Total incidence of indirect taxes using the total current income

Income decile	Per capita income			Per capita expenditure			Effective tax rate: income (%)			Effective tax rate: expenditure (%)		
	2014	*2016*	*2017*	*2014*	*2016*	*2017*	*2014*	*2016*	*2017*	*2014*	*2016*	*2017*
1	1,349,811	1,535,865	1,587,218	1,842,464	2,104,868	2,101,977	5.091	6.561	8.205	3.624	4.262	5.864
2	2,171,308	2,534,472	2,599,687	2,652,740	3,050,283	3,089,521	4.801	5.824	7.242	3.787	4.653	5.845
3	2,870,252	3,375,482	3,440,864	3,282,137	3,812,152	3,784,450	4.859	5.405	6.880	4.000	4.599	5.980
4	3,625,626	4,309,111	4,352,243	3,948,370	4,573,127	4,694,473	4.629	5.524	6.656	4.038	5.031	5.928
5	4,576,366	5,348,605	5,429,351	4,739,591	5,187,136	5,480,414	4.884	4.783	6.842	4.323	4.617	6.208
6	5,751,931	6,589,150	6,761,567	5,579,573	6,276,592	6,429,987	4.419	5.070	5.811	4.357	5.055	5.835
7	7,278,177	8,205,195	8,528,514	6,914,617	7,259,464	7,949,265	4.599	4.656	5.890	4.596	4.945	6.027
8	9,554,873	10,500,000	11,300,000	8,787,628	8,700,517	9,728,272	4.653	4.465	5.713	4.748	5.047	6.222
9	14,000,000	14,900,000	16,800,000	11,800,000	11,800,000	14,200,000	4.522	4.554	5.692	4.941	5.298	6.329
10	38,900,000	37,700,000	45,800,000	29,500,000	32,000,000	33,300,000	4.311	4.320	5.102	5.348	5.909	6.509
Total	9,000,945	9,498,223	10,600,000	7,906,539	8,472,453	9,069,062	4.677	5.121	6.405	4.376	4.943	6.074

Notes. We annualized the income and expenditures of the household. Indirect tax estimates are computed using both the frequent and occasional expenses. Self-consumption and self-supply expenses are excluded from the estimates. The reported per capita income is the current income. *Source.* Authors' calculations using data from the 2014 ECV and 2016-2017 ENPH.

Table C4

Total incidence of indirect taxes using the total current monetary income

Income decile	Per capita income			Per capita expenditure			Effective tax rate: income (%)			Effective tax rate: expenditure (%)		
	2014	*2016*	*2017*	*2014*	*2016*	*2017*	*2014*	*2016*	*2017*	*2014*	*2016*	*2017*
1	953,961	1,122,957	1,190,593	2,147,957	1,565,244	1,550,819	9.237	8.691	11.391	3.457	7.031	9.643
2	1,696,760	2,041,153	2,072,680	2,988,487	2,428,619	2,412,769	6.238	7.484	9.212	3.780	6.617	8.489
3	2,312,377	2,789,194	2,820,366	3,781,584	2,982,746	3,052,221	5.997	6.994	8.931	3.927	6.760	8.423
4	2,997,376	3,557,616	3,623,209	4,138,319	3,515,865	3,633,773	5.833	6.422	7.923	4.018	6.548	7.892
5	3,815,970	4,475,460	4,583,011	5,003,782	4,269,493	4,377,036	5.556	6.379	7.763	4.262	6.606	8.327
6	4,860,076	5,634,266	5,768,140	5,764,226	5,020,769	5,138,974	5.105	6.239	7.071	4.320	7.445	7.815
7	6,214,165	7,166,115	7,414,107	7,020,297	5,597,408	6,217,070	5.392	5.150	6.669	4.556	6.719	7.858
8	8,221,136	9,211,641	9,806,289	9,709,808	6,973,404	7,816,209	5.524	5.340	6.956	4.816	7.008	8.748
9	12,000,000	13,200,000	14,600,000	11,600,000	9,292,821	10,900,000	5.354	5.156	6.573	5.155	6.967	8.650
10	32,100,000	34,400,000	41,100,000	26,400,000	7,600,000	24,000,000	5.034	4.939	5.858	5.725	8.663	9.136
Total	7,502,766	8,314,392	9,266,001	7,845,345	5,903,879	6,902,180	5.929	6.284	7.837	4.400	7.032	8.498

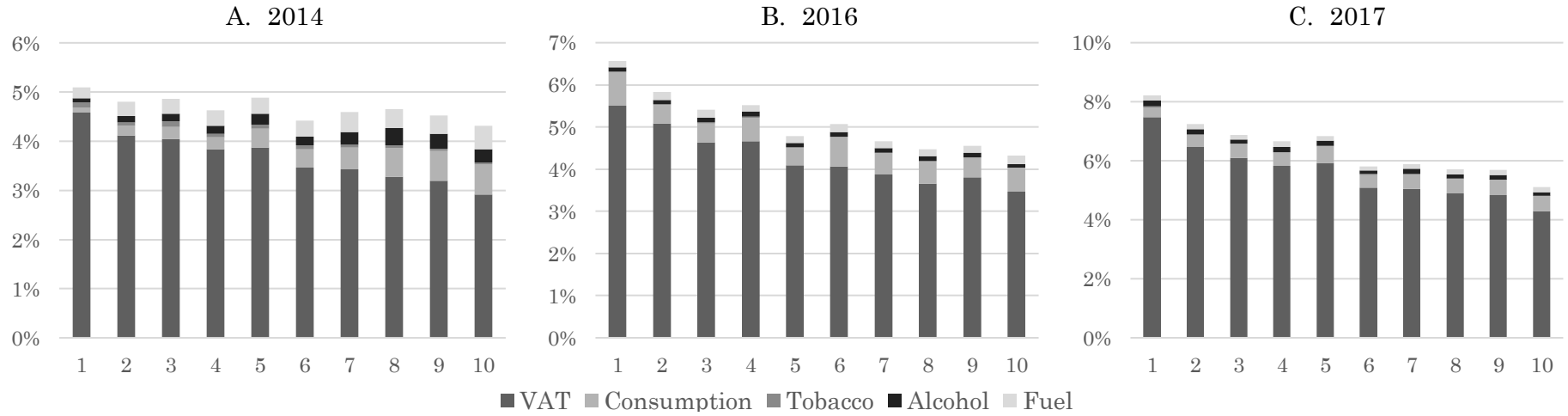
Notes. We annualized the income and expenditures of the household. Indirect tax estimates are computed using both the frequent and occasional expenses. Self-consumption and self-supply expenses are excluded from the estimates. The reported per capita income is the current income. *Source.* Authors' calculations using data from the 2014 ECV and 2016-2017 ENPH.

Table C5
Incidence of indirect taxes from monetary expenditures using the total current monetary income

Income decile	Per capita income			Per capita expenditure			Effective tax rate: income (%)			Effective tax rate: expenditure (%)		
	2014	*2016*	*2017*	*2014*	*2016*	*2017*	*2014*	*2016*	*2017*	*2014*	*2016*	*2017*
1	953,961	1,122,957	1,190,593	2,147,957	1,565,244	1,550,819	5.305	5.624	7.149	2.563	4.093	5.382
2	1,696,760	2,041,153	2,072,680	2,988,487	2,428,619	2,412,769	4.620	5.367	6.647	2.924	4.529	5.709
3	2,312,377	2,789,194	2,820,366	3,781,584	2,982,746	3,052,221	4.492	5.051	6.672	3.029	4.696	6.089
4	2,997,376	3,557,616	3,623,209	4,138,319	3,515,865	3,633,773	4.226	4.793	6.372	3.068	4.689	6.244
5	3,815,970	4,475,460	4,583,011	5,003,782	4,269,493	4,377,036	4.356	4.703	5.962	3.341	4.752	6.124
6	4,860,076	5,634,266	5,768,140	5,764,226	5,020,769	5,138,974	3.799	5.108	5.865	3.266	5.592	6.438
7	6,214,165	7,166,115	7,414,107	7,020,297	5,597,408	6,217,070	3.859	4.137	5.641	3.389	5.154	6.469
8	8,221,136	9,211,641	9,806,289	9,709,808	6,973,404	7,816,209	4.301	4.468	5.668	3.753	5.592	6.811
9	12,000,000	13,200,000	14,600,000	11,600,000	9,292,821	10,900,000	3.810	4.366	5.640	3.867	5.913	7.261
10	32,100,000	34,400,000	41,100,000	26,400,000	17,600,000	24,000,000	3.454	4.159	5.277	4.084	7.181	8.232
Total	7,502,766	8,314,392	9,266,001	7,845,345	5,903,879	6,902,180	4.224	4.781	6.090	3.328	5.215	6.474

Notes. We annualized the income and expenditures of the household. Indirect tax estimates are computed using both the frequent and occasional expenses. Self-consumption and self-supply expenses are excluded from the estimates. The reported per capita income is the current income. *Source.* Authors' calculations using data from the 2014 ECV and 2016-2017 ENPH.

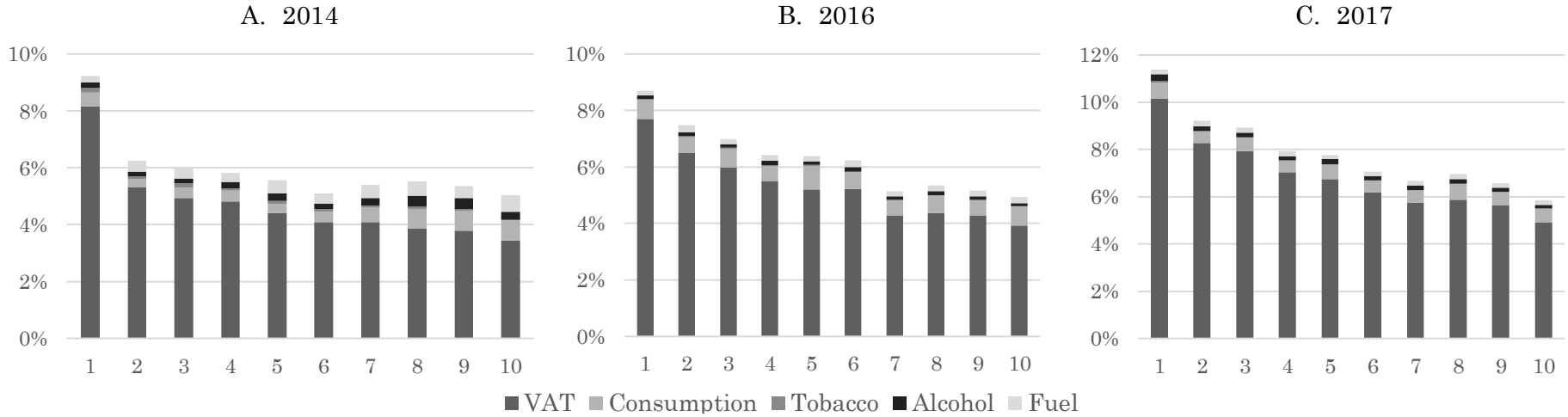
Figure C1
Tax incidence on the total current income by type of tax and income decile



Source. Authors' calculations using data from the 2014 ECV and 2016-2017 ENPH.

Figure C2

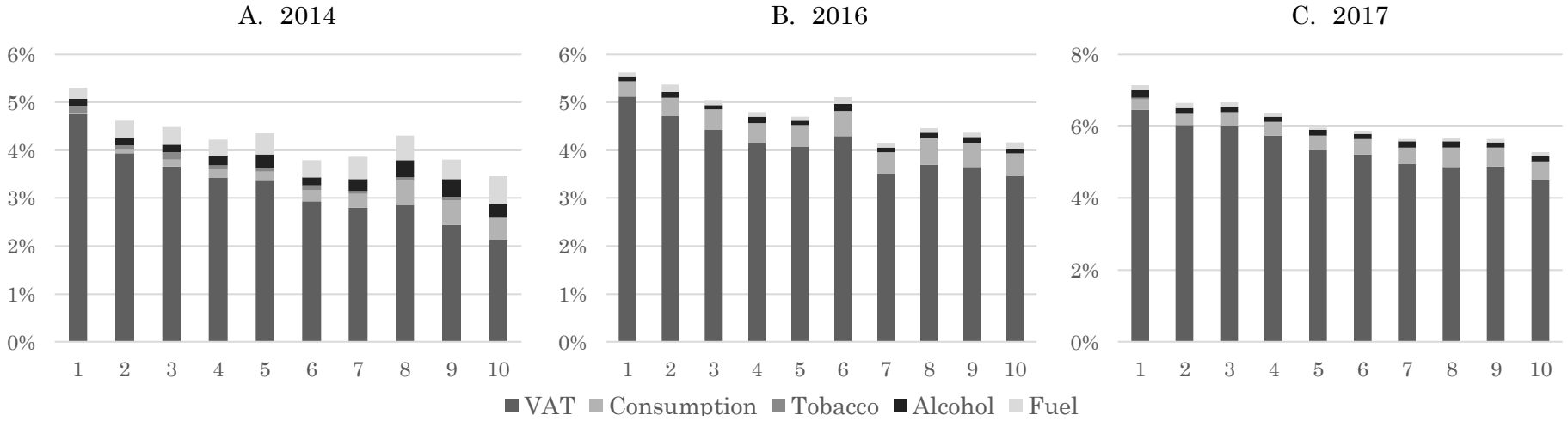
Tax incidence on the total current monetary income by type of tax and income decile



Source. Authors' calculations using data from the 2014 ECV and 2016-2017 ENPH.

Figure C3

Tax incidence on the total current income by type of tax and income decile, using monetary expenditures



Source. Authors' calculations using data from the 2014 ECV and 2016-2017 ENPH.

When we look at the breakdown by type of tax (Figures C1 to C3), in general, the value-added tax is the largest component of indirect taxes averaging over 4% of households' income, followed by consumption tax and fuel taxes (fuel tax, surcharge on gasoline and diesel, and carbon tax). The proportion of income that is spent on VAT is higher for the poorest decile than for the richest decile. The lowest component comes from alcohol (beer, wine, and spirits) and tobacco taxes. In the case of expenditures that increase as a function of the income level of the household (*e.g.*, consumption, fuel and, to a lesser extent, tobacco), the incidence of taxes is slightly higher for the highest deciles.

Tariffs and import duties

Table C6 shows the total incidence of tariffs and import duties as a proportion of households' income by decile. We present estimates for the incidence of tariffs and import duties on the total current income, total current monetary income, and total current income using monetary expenditures. On average, the incidence of tariffs and import duties increased over time from 0.22% in 2014 to 0.33% in 2016-2017 using the total current income. Now, the results show a higher incidence for low-income households with a slight increase in the last deciles in most cases.

Table C6
Total incidence of tariffs and import duties

Income decile	Percent of total current income			Percent of total current monetary income			Percent of total current income using monetary expenditures		
	2014	*2016*	*2017*	*2014*	*2016*	*2017*	*2014*	*2016*	*2017*
1	0.235	0.676	0.454	0.423	0.695	0.638	0.201	0.425	0.356
2	0.214	0.404	0.363	0.312	0.531	0.473	0.169	0.360	0.320
3	0.226	0.353	0.339	0.269	0.461	0.435	0.155	0.318	0.316
4	0.209	0.330	0.332	0.309	0.383	0.399	0.149	0.290	0.303
5	0.252	0.292	0.322	0.224	0.354	0.389	0.135	0.277	0.282
6	0.179	0.290	0.304	0.220	0.338	0.356	0.125	0.273	0.283
7	0.210	0.267	0.279	0.290	0.320	0.320	0.121	0.241	0.265
8	0.221	0.276	0.266	0.222	0.335	0.326	0.118	0.269	0.256
9	0.200	0.279	0.284	0.230	0.313	0.322	0.105	0.247	0.267
10	0.230	0.266	0.309	0.271	0.304	0.351	0.092	0.275	0.298
Total	0.218	0.344	0.325	0.277	0.404	0.401	0.137	0.298	0.294

Notes. We annualized the income and expenditures of the household. We use both the frequent and occasional expenses. Self-consumption and self-supply expenses are excluded from the estimates. *Source.* Authors' calculations using data from the 2014 ECV and 2016-2017 ENPH.

D. Generating revenues and expenditures age profiles in the GEIH

The following list defines the variables used in the datasets derived from the GEIH data to generate the age profiles for taxes paid and benefits received, as shown in Section 5.3 in the paper. In addition, here we describe the source data, the aggregates to which totals are normalized, and the assumptions underlying tax revenues and various benefits and public goods costs used in the fiscal impact estimates. Some flows are not attributable to individuals but instead can be assigned to everyone in the population on a per capita basis. Each measured flow is adjusted by a single multiplicative factor so that the population-weighted aggregate is consistent with total revenues and expenditures of the General Government budget.

D.1. Individual and group characteristics

Variable	*year*
Definition	Year of pooled GEIH samples
Description	GEIH variable *year*.

Variable	*sex*
Definition	Sex
Description	0 Male 1 Female

Variable	*age*
Definition	Age
Description	GEIH individual-level variable *p6040*.

Variable	*immig*
Definition	Immigration groups
Description	0 Permanent natives 1 Returnees 2 Venezuelan-born, arrived less than 1 year ago 3 Venezuelan-born, arrived 1-5 years ago 4 Venezuelan-born, arrived more than 5 years ago 5 All other foreign-born

Variable	*educ*
Definition	Education group
Description	1 Less than HS 2 HS graduate 3 Some college

	4 Bachelor's degree 5 Any post bachelors

Variable	*wgsal*
Definition	Wages and salary income
Description	GEIH individual-level variable *inglabo*.

Variable	*indep*
Definition	Independent person
Description	0 Dependent 1 Independent We consider dependents any person (1) under the age of 18, (2) from 18 to 22 years old and enrolled full time in secondary education, or (3) from 18 to 22 years old in higher education or not, and who is working less than half time. If a person is married, they are considered independent, regardless of their age.

Variable	*ndep*
Definition	Number of dependents
Description	Number of dependents for each independent person, excluding those not part of the household unit.

Variable	*emp*
Definition	Employment status
Description	0 Not employed 1 Employed

Variable	fex12
Definition	Individual sample weight
Description	Individual weight for the pooled sample, defined as GEIH individual-level variable *fex_c_2011* divided by 12.

D.2. General Government revenues

Variable	*inctx*
Definition	Income tax
Description	Own estimate using year-specific tax rates of the ordinary system applied to gross annualized taxable income. Our estimates include both the income tax for those individuals above the income threshold in each year and an estimate of tax withholdings for those not required to fil a tax return.

Variable	*ss_hlth*
Definition	Contributions to the contributory health care regime
Description	Own estimate using year-specific rates applied to the estimated Contribution Base Income for all employed or independent persons.

Variable	*ss_colp*
Definition	social security contributions to COLPENSIONES
Description	Own estimate using year-specific rates applied to the estimated Contribution Base Income.

Variable	*ss_fgpm*
Definition	Social security contributions to the minimum pension guarantee fund (FGPM)
Description	1,5% of the estimated Contribution Base Income (IBC) for those enrolled in a private pension fund (RAIS).

Variable	*ss_fsp*
Definition	Social security contributions to the pension solidarity fund (FSP)
Description	Own estimate using year-specific rates applied to the estimated Contribution Base Income.

Variable	*ss_spr*
Definition	Social security contributions to special regimes (e.g., police and the national railway fund)
Description	Assigned equally to all employed or independent persons enrolled in a special regime.

Variable	*pt_sena*
Definition	Payroll taxes to SENA
Description	Own estimate using year-specific rates applied to the estimated base salary.

Variable	*pt_icbf*
Definition	Payroll taxes to ICBF
Description	Own estimate using year-specific rates applied to the estimated base salary.

Variable	*pt_esap*
Definition	Payroll taxes to ESAP
Description	Own estimate using year-specific rates applied to the estimated base salary.

Variable	*pt_inds*
Definition	Payroll taxes to industrial schools
Description	Own estimate using year-specific rates applied to the estimated base salary.

Variable	*corptx_npo*
Definition	Corporate and capital taxes (national public ownership)
Description	Assigned equally to all natives.

Variable	*corptx_rhh*
Definition	Corporate and capital taxes (resident households)
Description	Assigned equally to all those receiving individual dividend and interest income.

Variable	*wlthtx*
Definition	Wealth tax (households)
Description	Assigned proportionately using our estimate of real estate values in the 90th percentile for property owners.

Variable	*vattx*
Definition	Value-added tax (households)
Description	Own estimate using decile-specific effective VAT tax rates applied to households' gross income. We distribute each household's total payments in VAT to all members of the household using individual contributions to the household gross income.

Variable	*constx*
Definition	Consumption tax
Description	Own estimate using decile-specific effective consumption tax rates applied to households' gross income. We distribute each household's total payments in consumption tax to all members of the household using individual contributions to the household gross income.

Variable	*tobtx*
Definition	Tobacco tax
Description	Own estimate using decile-specific effective tobacco tax rates applied to households' gross income. We distribute each household's total payments in tobacco tax to all members of the household using individual contributions to the household gross income.

Variable	*alctx*

Definition	Alcohol taxes (beer, wine and spirits)
Description	Own estimate using decile-specific effective alcohol tax rates applied to households' gross income. We distribute each household's total payments in alcohol tax to all members of the household using individual contributions to the household gross income.

Variable	*fueltx*
Definition	Fuel taxes (fuel tax, surcharge on gasoline and diesel, and carbon tax)
Description	Own estimate using decile-specific effective fuel tax rates applied to households' gross income. We distribute each household's total payments in fuel tax to all members of the household using individual contributions to the household gross income.

Variable	*impdut*
Definition	Import duties (households)
Description	Own estimate using decile-specific effective tariffs and import duties applied to households' gross income. We distribute each household's total payments in tariffs and import duties to all members of the household using individual contributions to the household gross income.

Variable	*mvtx*
Definition	Motor vehicle tax
Description	Assigned equally to all households with ownership of a motor vehicle. The household's per capita contribution is split equally among all adult (18+) members.

Variable	*proptx*
Definition	Property tax (households)
Description	Own estimate using the real estate values for property owners. Each household's share in the property tax is distributed among the head of the household, his/her spouse or partner, and those members who report rental income and are classified as an independent person. We impute the average for all missing observations in each strata and bottom code to 1 million pesos.

Variable	*icatx*
Definition	Industry and trade tax (households)
Description	Assigned equally to all self-employed owning an industrial, commercial, or service business.

Variable	*gmftx*

Definition	Financial transactions tax (households)
Description	Own estimate using expenditures-to-income ratio by decile. We then allocate financial transactions tax using the share of each individual's expenditure among those with monthly expenditures above 350 units of tax value.

Variable	*gos_avg*
Definition	Gross operating surplus, rents and royalties (average contribution)
Description	Assigned equally to all adults (18+).

Variable	*gos_mg*
Definition	Gross operating surplus, rents and royalties (marginal contribution)
Description	Assigned equally to all permanent natives.

Variable	*phtx*
Definition	Urban phones tax
Description	Assigned equally to all adults (18+) with access to a landline.

Variable	*edserv*
Definition	Educational services
Description	Assigned equally to all enrolled in higher education in public establishments.

Variable	*fomag*
Definition	National Teachers Pension Fund
Description	Assigned equally to all employees in the education sector classified as government workers.

Variable	*immcert*
Definition	Immigration certificates
Description	Assigned equally to all foreign-born.

Variable	*othtx*
Definition	All remaining tax payments, fees, fines and penalties, and other receipts
Description	Assigned equally to all adults (18+).

D.3. General Government expenditures

Variable	*ppgds_avg*
Definition	'Pure' public goods spending (average cost)

Description	Distributed on a per capita basis to the entire population.

Variable	*ppgds_mg*
Definition	'Pure' public goods spending (marginal cost)
Description	Distributed on a per capita basis to permanent natives.

Variable	*cpgds*
Definition	'Congestible' public goods spending
Description	Distributed on a per capita basis to the entire population.

Variable	*lawpri*
Definition	Law courts and prisons spending
Description	Distributed on a per capita basis by group. Per capita cost for each group (natives, Venezuelan-born, rest of foreign-born) is estimated using the share of each group in the prison population and applying these shares to total spending in *law courts and prisons*, then dividing equally among the total adult (18+) population in the GEIH in each case. Information on the nationality of prison inmates comes from the National Penitentiary and Prison Institute, INPEC.

Variable	*water*
Definition	Water supply spending
Description	Assigned equally to all households with access to water supply, divided equally among all household members.

Variable	*hcserv*
Definition	Health care services spending
Description	Assigned based on SGSSS enrollment (GEIH variable *p6100*) but weighted by total per capita personal health care cost by age group and regime from the Ministry of Health. We assign the complete value of the capitation payment unit (UPC) to those affiliated to either the contributory (including those affiliated to special regimes) or subsidized regime and 45% of the UPC for the subsidized regime as the cost of health services for those not affiliated.

Variable	*ed_comp_avg*
Definition	Education benefits: compulsory education (average cost)
Description	Assigned equally to all individuals [3,16] years old attending compulsory education in public institutions.

Variable	*ed_comp_mg*
Definition	Education benefits: compulsory education (marginal cost)

Description	Assigned equally to all individuals [3,16] years old attending compulsory education in public institutions, excluding those with residence less than 1 year.

Variable	*ed_job*
Definition	Education benefits: job training
Description	Assigned equally to all enrolled in job training programs.

Variable	*ed_tert*
Definition	Education benefits: higher education
Description	Assigned equally to all enrolled in higher education in public establishments.

Variable	*sp_dis*
Definition	Social protection benefits: sickness and disability
Description	Assigned equally to all inactive population that left their last job within a year due to illness or accident.

Variable	*sp_pen*
Definition	Social protection benefits: pensions
Description	GEIH individual-level variables for pension income and Colombia Mayor (*p7500s2a1+p1661s3a1*). We impute the minimum wage for pension income for all missing observations that reported to have received the income, and the average for Colombia Mayor.

Variable	*sp_fch*
Definition	Social protection benefits: family and children
Description	GEIH individual-level variable *p1661s1a1*. We impute the average income (depending on the number of children in the household unit) for all missing observations that reported to have received the benefit. Allocation is made by adding all family and children benefits in a family unit and dividing evenly among all children 0-6 years old or 6-20 years that are enrolled in compulsory education. For those observations that report receiving the benefits but do not have children between those ages, we allocate the value evenly among all household members.

Variable	*sp_unem*
Definition	Social protection benefits: unemployment
Description	Assigned equally to all unemployment benefit recipients.

Variable	*sp_hous*
Definition	Social protection benefits: housing

Description	GEIH individual-level variables for income of all housing-related benefits claimants (2013-2015: p7500s2a1; 2016-2018: p1661s4a2). We impute the average subsidy for all missing observations that reported to have received the benefit. Allocation is made by adding all benefits in a family unit and dividing evenly among all household members.

Variable	*sp_vul*
Definition	Social protection benefits: vulnerable population
Description	Assigned equally to all individuals classified as vulnerable (immigrants, internally displaced or in poverty).

Variable	*debtserv*
Definition	Interest payments on the debt
Description	Distributed on a per capita basis to the entire population. Allocation to immigrants (including returnees) is conditioned to the year of arrival to the country.

D.4. Summary variables

Variable	*totrev_avg*
Definition	Total revenues (average effect)
Description	Sum of the following variables: inctx, ss_hlth, ss_colp, ss_fgpm, ss_fsp, ss_spr, pt_sena, pt_icbf, pt_esap, pt_inds, corptx_npo, corptx_rhh, wlthtx, vattx, constx, tobtx, alctx, fueltx, impdut, mvtx, proptx, icatx, gmftx, **gos_avg**, phtx, edserv, fomag, immcert, othtx

Variable	*totrev_mg*
Definition	Total revenues (marginal effect)
Description	Sum of the following variables: inctx, ss_hlth, ss_colp, ss_fgpm, ss_fsp, ss_spr, pt_sena, pt_icbf, pt_esap, pt_inds, corptx_npo, corptx_rhh, wlthtx, vattx, constx, tobtx, alctx, fueltx, impdut, mvtx, proptx, icatx, gmftx, **gos_mg**, phtx, edserv, fomag, immcert, othtx

Variable	*totexp_avg*
Definition	Total expenditures (average effect)
Description	Sum of the following variables:

Variable	*totexp_mg*
Definition	Total expenditures (marginal effect)
Description	Sum of the following variables:

Variable	*totnet_avg*
Definition	Net total impact (average effect)
Description	Difference between revenues and expenditures in the *average* effect scenario= totrev_avg – totexp_avg

Variable	*totnet_mg*
Definition	Net total impact (marginal effect)
Description	Difference between revenues and expenditures in the *marginal* effect scenario= totrev_mg – totexp_mg

Variable	*rerat_avg*
Definition	Revenues to expenditures ratio (average effect)
Description	Ratio of revenues to expenditures in the *average* effect scenario = totrev_avg/totexp_avg

Variable	*rerat_mg*
Definition	Revenues to expenditures ratio (marginal effect)
Description	Ratio of revenues to expenditures in the *marginal* effect scenario = totrev_mg/totexp_mg

Variable	*defl*
Definition	GDP deflators
Description	Own estimate of GDP deflators (2018 prices) using information from the National Accounts reported by DANE

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