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Identifying the Main Emitters of Carbon Dioxide in Mexico: A Multi-Sectoral Study

ABSTRACT In this paper, input-output and SAM-based multiplier models are formulated to identify the main emitters of direct, indirect, and induced carbon dioxide (CO_2) for the Mexican economy. The models are based on a social accounting matrix for Mexico, with disaggregated household income and consumption patterns according to the official poverty line. The results show that the final users of the inputs that embody high levels of CO_2 emissions are the next five sectors: (1) construction; (2) electricity, gas, and water supply; (3) inland transport; (4) food, beverages, and tobacco; and (5) coke, refined petroleum, and nuclear fuel. The findings suggest that the implementation of a carbon tax could damage poor families, since these families generate high direct, indirect, and induced CO_2 emissions per unit of income, as a consequence of their consumption patterns of fuels and the products that embody high CO_2 emissions levels (for example, agriculture, hunting, forestry, and fishing).

JEL Classifications: C58, I3, Q21, Q56
Keywords: social accounting matrix, greenhouse gas emissions, poverty

Following the guidelines of Mexico's Special Climate Change Program (SCCP) for 2009–12, countries were grouped based on 2005 data for three characteristics: gross domestic product (GDP), population, and greenhouse gas (GHG) emissions. Mexico was grouped among the countries with a high GDP, high population, and high emissions.[1] In this SCCP, Mexico set an ambitious target: to decrease its GHG emissions from the 2000 level by approximately 50 percent by 2050. This implies a change from 664 to 339 million

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1. This group includes Brazil, France, Germany, India, Indonesia, Italy, Japan, Russia, South Korea, Turkey, the United Kingdom, and the United States.

tons of carbon dioxide (CO_2) equivalent. For comparison, projections indicate that, with no intervention, Mexico would reach a level of 1,089 million tons by 2050.

The interventions described in the SCCP consist of three primary policies: national financial cooperation, technology transfer, and international agreements. These interventions are expected to target the main sectors classified in the GHG emissions inventory as being the first sources of emissions: namely, energy (CO_2, methane); industrial processes (CO_2, others); agriculture (methane, nitrous oxide); land use, land-use change, and forestry (CO_2); and waste (methane). In 2010, CO_2 contributed to 65.9 percent of the total GHG emissions in Mexico.[2]

Some of the SCCP policies include carbon taxes on fossil fuels and investment in clean energy. The General Law of Climate Change, passed in June 2012, established a goal of increasing the energy generated from clean sources by up to 35 percent by 2024.[3] In addition, in 2014, the Mexican Congress approved a fiscal reform that included a carbon tax on CO_2 emissions from the production, sale, and burning of fossil fuels to discourage activities that harm the environment, to improve air quality, and to reduce respiratory illness.[4] The justification for this tax was to internalize the social cost of the negative externalities of CO_2 emissions from fossil fuels and encourage the use of clean renewable energies.

Nevertheless, there are concerns regarding the effects of GHG emission mitigation policies on developing countries with high poverty levels, including Mexico. Mexico experienced an increase in poverty from 1992 to 1996, when the poverty level peaked at 69 percent. Poverty then decreased between 1996 and 2006, reaching 42.9 percent in 2006. Since then, the level of poverty has increased consistently, although it has not returned to the high 1996 levels. In 2014, 55.1 percent of people in Mexico were poor.[5] Concerns arise from the fact that GHG emission mitigation policies could reduce economic growth and increase poverty. A few policies try to combine sustainability with low poverty. For example, the Program for the Conservation for Sustainable Development (PROCODES) proposes to decrease GHG emission levels to preserve the environment and mitigate climate change. Such

2. SEMARNAT (2012).
3. DOF (2012).
4. DOF (2013).
5. According to the National Council for the Evaluation of Social Development Policy (CONEVAL), this measure of income poverty is known as patrimony poverty.

conservation programs also have education, health, and work components, but their effects are too small to have a significant influence, as evaluations have shown.[6] The idea is to combine the policies of sustainable growth and poverty alleviation.

The primary aim of this paper is to shed light on the mechanisms that link poverty and GHG emissions. This research contributes to the analysis of the environmental impact in Mexico by studying the relationship between CO_2 emissions and the income and expenditure patterns of economic sectors and households. For this purpose, we construct a social accounting matrix (SAM) for Mexico using the most recent official input-output (IO) matrix from the National Statistics Office for 2008. The IO and the SAM-based multiplier models were formulated to quantify the CO_2 emissions of economic sectors, factors of production, and households.

The SAM constructed in this study involves the consumption and income patterns of eight family types differentiated by the official poverty condition, defined by the National Council of Social Program Evaluations.[7] Ruiz measures the impact of GHG emissions and explores policy options to promote clean technologies or increase the cost of emissions; such policies affect the most polluting and productive sectors.[8] To date, no studies have measured the impact of those policies on poor households. This research contributes to the literature by being the first study for Mexico that analyzes the GHG emissions related to different types of households, classified according to poverty conditions.

Studies have investigated whether or not non-poor families generate more pollutants than poor families. In quantity terms, the expenditure of non-poor families is higher than that of poor families. This suggests that higher CO_2 emissions would be linked to non-poor family consumption, rather than products bought by poor families. However, in relative terms, the answer to this question depends on the consumption patterns of the families. For instance, non-poor families may buy products that consume less energy than poor families, for example, television sets, refrigerators, and cars with more advanced technology and thus emitting lower amounts of CO_2. Consequently, there is a high interest in assessing which household type is producing more CO_2 emissions per unit of income.

Multi-sector models have been extensively applied to environmental analyses: emission multipliers, structural decomposition multipliers, and

6. Orta and others (2013).
7. CONEVAL (2010, 2013).
8. Ruiz Nápoles (2012).

the economic and redistributive effects of emission mitigation policies.[9] In the case of Mexico, a number of studies apply IO models and SAM-based multiplier and general equilibrium models to analyze the environmental impact of economic policies and the redistributive effects of policies designed to mitigate GHG emissions.[10] However, none of these studies look at the impact on the poor.

In this study, we employ the concept of vertically integrated industries to identify the final user of the inputs that embody CO_2 emissions.[11] The SAM-based multiplier model was formulated to compute CO_2 emission multipliers, taking into account the circular flow of income. The main results suggest that sectors like construction; electricity, gas and water supply; inland transport; food, beverages, and tobacco; and coke, refined petroleum, and nuclear fuel are the major generators of CO_2 emissions through their intermediate consumption. Among household types, the highest emissions are related to non-poor households, but poor households show higher CO_2 multipliers than non-poor families, meaning that although their emissions are lower, their impact per monetary unit of income is higher than that of the non-poor.

The rest of this paper is organized as follows. The next section describes the construction of the SAM. The paper then presents a descriptive analysis of CO_2 emissions in Mexico. Subsequently, we derive and discuss the vertically integrated effects and formulate the SAM-based multiplier model. The conclusions and recommendations for future research are presented in the final section.

Building the SAM from the 2008 IO Matrix

A social accounting matrix (SAM) is a double-entry table that identifies the income-expenditure relationships between the agents involved in an economy: households, primary factors, enterprises or sectors, the government, and

9. For more detail on IO applications, see Xu and Dietzenbacher (2014); Rueda-Cantuche and Amores (2010): Su and Ang (2011): Cansino and others (2012): Duarte, Mainar, and Sánchez-Chóliz (2013): Liu and others (2014): Guo, Zhang, and Meng (2012): Gui, Mu, and Li (2014): and Wiedmann (2009). For examples of SAM-based multiplier models, see Hartono and Resosudarmo (2008): Parikh and others (2009): Llop and Pié (2011): Ge and Lei (2013): and Morilla, Díaz-Salazar, and Cardenete (2007).

10. These studies include Aroche Reyes (2000); Ruiz Nápoles (2012); Gale (1995); Castillo (2010); Bravo Pérez, Castro Ramírez, and Gutiérrez Andrade (2013); Uri and Boyd (1997); and Becerril and Albornoz (2010).

11. Pasinetti (1973).

a foreign sector. A SAM is a square matrix in which each row and column is called an account. Since the SAM reflects where the income comes from (income row) and how it is spent (expenditure column), it must balance perfectly. The income must be equal to the expenditure for each account. In general, the accounts are divided into economic sectors, factors of production, and institutions (such as households, the government, and the rest of the world).

The level of disaggregation that the study required determined the sources of information to consider. In this research, our interest lies in studying the CO_2 emissions related to expenditure and income patterns. Therefore, the CO_2 emissions data, by economic sector, determine the sectoral aggregation detail.

We developed a SAM for Mexico, with reference to 2008, including the income-expenditure relationships of thirty-five economic activities or sectors (EA), eight household types (H), owners of the private capital factor (CORP), three types of work (L) classified according to schooling level, private and public capital (K and PK), a government institution (G), two savings and investment identities (Priv S-I and Pub S-I), and the rest of the world (ROW).

The SAM was built using a top-down method. First, we built an aggregate SAM employing the 2008 institutional sector accounts (ISA) from the National Institute of Statistics, Geography, and Information (INEGI).[12] This aggregate SAM was disaggregated by economic sector, using the input-output table for 2008, and by household type, using the 2008 National Survey of Income and Expenditures of the Household (ENIGH). For example, in the derivation of the submatrix that includes the remunerations W paid by a given economic sector (or economic activity, EA) according to schooling level (W_{LEA}), we used the results of the 2008 ENIGH. The base of the calculation is the row vector of remunerations by the sector of the dimension (1×35) of the 2008 Mexican input-output table; this vector is identified as $\mathbf{W}_{EA}$. However, using the results from the 2008 ENIGH, we derived a matrix $\mathbf{MW}_{LEA}$ that contains the proportion of total remunerations paid by the economic sector EA to the schooling level L. We then performed the following operation:

$$\underset{(3\times35)}{\mathbf{W}_{LEA}} = \underset{(3\times35)}{\mathbf{MW}_{LEA}}\, \underset{(35\times35)}{\mathbf{MDW}_{EA}},$$

where $\mathbf{MDW}_{EA}$ is a diagonal matrix containing the total remunerations paid by each economic sector EA in its main diagonal. The dimension arises as there are thirty-five economic sectors and three labor types (unskilled, semi-skilled, and skilled).

12. INEGI (2014).

Other sources used to perform the disaggregation include the Macroeconomic Indicators of the Public Sector (published by INEGI), and the Presidencia de la República (2009).[13] Table 1 identifies the accounts included in the matrix. Table A1 in the appendix contains the structure of the SAM, the submatrixes, a general description, and the sources, while table A2 presents the Mexican SAM for 2008.

The main difference between this study and others is that household types are classified according to poverty condition, using the official poverty lines established by the National Council for the Evaluation of Social Development Policy (CONEVAL).[14] There are three income poverty definitions according to severity in food, capabilities, and patrimony. *Food poverty* measures the number of people (either rural or urban) who cannot afford the food basket, even when they spend all of their income. *Capabilities poverty* measures the number of people who cannot afford the food basket, health, and education, even when they spend all of their income. *Patrimony poverty* includes the number of people who cannot afford the food basket, health, education, transportation, housing, and clothing, even when they spend all of their income. For the base year, 2008, these three poverty lines represented 18.6 percent, 25.5 percent, and 47.8 percent of the population, respectively. In the last measure, in 2014, they increased to 20.5 percent, 29.1 percent and 55.1 percent, respectively.[15] Considering that the patrimony poverty line includes the capabilities line and the food poverty line, the population was classified into just one poverty line, so that households could be tracked across poverty types in rural or urban areas. This yielded eight types of households: three poor, one non-poor, and their respective urban and rural counterparts.

CO_2 Emissions in Mexico

To match production to CO_2 emissions, we used the World Input-Output Database (WIOD).[16] This database is part of a project conducted by the European Commission. It involves environmental accounts that present CO_2 modeled

13. INEGI (2012); Presidencia de la República (2009).
14. CONEVAL (2010).
15. CONEVAL also calculates the "well-being poverty line." According to this definition, 53.2 percent of the people were poor in 2014.
16. The WIOD is available online at www.wiod.org/new_site/data.htm. See Timmer (2012) for a description of the database.

TABLE 1. Institutional Sectors Included in the Mexican SAM 2008

Account	*Description*	*Account*	*Description*
EA1	Agriculture, hunting, forestry, and fishing	EA35	Public admin and defense; compulsory social security and extraterritorial and international organizations
EA2	Mining and quarrying	L1	Less than complete secondary education
EA3	Electricity, gas, and water supply	L2	Complete secondary or incomplete high school education
EA4	Construction	L3	Complete high school or higher education
EA5	Food, beverages, and tobacco	K	Private capital
EA6	Textiles and textile products	PK	Public capital
EA7	Leather products, including footwear	H1	Food poverty in rural areas
EA8	Wood and products of wood and cork	H2	Capabilities poverty in rural areas
EA9	Pulp, paper, printing, and publishing	H3	Patrimony poverty in rural areas
EA10	Coke, refined petroleum, and nuclear fuel	H4	Non-poor in rural areas
EA11	Chemicals and chemical products	H5	Food poverty in urban areas
EA12	Rubber and plastics	H6	Capabilities poverty in urban areas
EA13	Other nonmetallic minerals	H7	Patrimony poverty in urban areas
EA14	Basic metals and fabricated metals	H8	Non-poor in urban areas
EA15	Machinery not elsewhere classified (NEC)	CORP	Owners of capital
EA16	Electrical and optical equipment	G	Government expenditure on goods and services
EA17	Transport equipment	OTrans	Government direct cash transfer program (*Oportunidades*)
EA18	Manufacturing (NEC); recycling	ProTrans	Government direct cash transfer program (*Procampo*)
EA19	Wholesale trade and commission trade, excluding motor vehicles and motorcycles	EdTrans	Government direct cash transfer program to elderly persons (*PAM*)
EA20	Retail trade, excluding motor vehicles and motorcycles, and repair of household goods	ROTrans	Rest of the government direct cash transfers to households
EA21	Wholesale trade of motor vehicles and motorcycles; retail sale of fuel and motor vehicles and motorcycles; and sale, maintenance, and repair of motor vehicles and motorcycles	SBG	Social benefits
EA22	Inland transport	VAT	Value added tax
EA23	Water transport	ITax	Income tax
EA24	Air transport	RNTPS	Rest of net taxes on products
EA25	Other supporting and auxiliary transport activities; activities of travel agencies	NTPN	Net taxes on production
EA26	Post and telecommunications	Mtar	Import tariffs
EA27	Financial intermediation	Priv S	Private saving
EA28	Real estate activities	Pub S	Public saving
EA29	Machinery and equipment rentals and other business activities	Priv I	Private investment
EA30	Education	Pub I	Public investment
EA31	Health and social work	ROW	Rest of the world
EA32	Other community, social, and personal services	RemH	Remittances
EA33	Hotels and restaurants	ChInv	Change in inventory
EA34	Private households with employed persons	Sdisc	Statistical discrepancy

Source: Authors' compilation.

by economic sector and fuel type and is available for forty countries for the period from 1995 to 2009.[17] We disaggregated the CO_2 emissions related to fuels used as intermediate inputs into thirty-five economic sectors following the European Statistical Classification of Economic Activities (NACE). For emissions linked to family fuel consumption, we divided the aggregate CO_2 emissions by household type based on fuel expenditure patterns, as explained below.

According to the WIOD Database, in 2008, the Mexican economy generated 430,798 kilotons of CO_2 emissions. Of this total, 82 percent (353,280 kilotons) originated from intermediate consumption by economic sectors; the remainder (12 percent, or 77,518 kilotons) was created by family fuel consumption. The following economic sectors directly generated the most CO_2 emissions: electricity, gas, and water supply (29 percent); coke, refined petroleum, and nuclear fuel (9 percent); mining and quarrying (8 percent); other nonmetallic minerals (8 percent); and inland transport (7 percent).[18] See figure 1 for more detail.

CO_2 emissions by household type ($CO2_H^F$) are approximated by relating the fuel expenditure distribution by household type to the CO_2 emissions corresponding to the final consumption of each fuel (namely, diesel, gasoline, natural gas, and other petrochemical products such as lubricants and motor oils), as follows:

$$CO2_H^F = CO2^F \gamma_H^F;$$

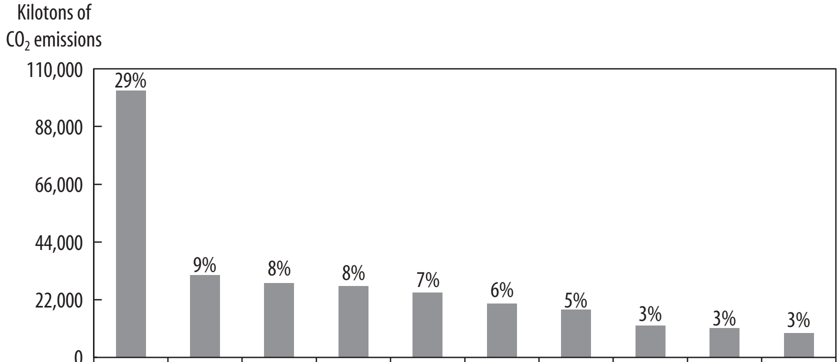
$$\gamma_H^F = \frac{XP_H^F}{XP^F};$$

where $CO2^F$ represents carbon emissions related to household consumption of fuel F; XP_H^F is expenditures on fuel F by household H (ENIGH 2008); and

17. See Genty, Arto, and Neuwahl (2012) for a detailed description of the environmental accounts.

18. The mining and quarrying sector is section C of the NACE; it is analogous to sector 21 of the North American Industrial Classification System (NAICS), which is defined as mining, quarrying, and oil and gas extraction. In the National Accounting System of Mexico, it is simply called mining. According to NACE, this economic sector includes the mining of coal and lignite; the extraction of peat; the extraction of crude petroleum and natural gas; service activities incidental to oil and gas extraction, excluding surveying; the mining of uranium and thorium ores; the mining of metal ores; and other mining and quarrying.

FIGURE 1. Primary Direct CO_2 Emitters in Mexico, 2008: Economic Sectors[a]



	EA3	EA10	EA2	EA13	EA22	EA1	EA14	EA4	EA11	EA20
CO_2 Emissions	101,719	31,359	28,214	27,076	24,793	20,513	18,129	12,094	11,079	9,248

Economic sector

Source: Genty, Arto, and Neuwahl (2012).

a. Percentage of total CO_2 emissions related to intermediate consumption. Sectors are identified as follows: EA3: electricity, gas, and water supply; EA10: coke, refined petroleum, and nuclear fuel; EA2: mining and quarrying; EA13: other nonmetallic minerals; EA22: inland transport; EA1: agriculture, hunting, forestry, and fishing; EA14: basic metals and fabricated metal; EA4: construction; EA11: chemicals and chemical products; and EA20: retail trade (excluding motor vehicles and motorcycles) and repair of household goods.

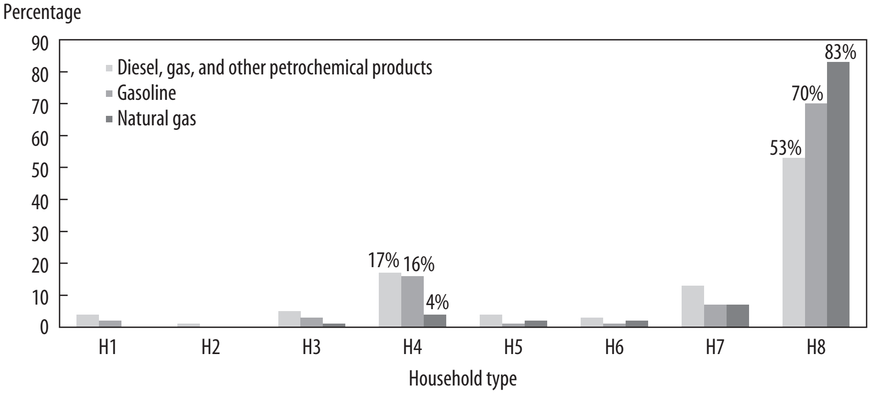
XP^F is total household expenditures on fuel *F*. Therefore, the CO_2 emissions for each household type (*H*) were obtained as

$$CO2_H = \sum_{F=1}^{nf} CO2_H^F,$$

where *nf* is the number of fuels. For this calculation, we use expenditure distributions from the 2008 Household Income and Expenditure Survey of Mexico (ENIGH), while the CO_2 emissions are provided by the WIOD.

Figure 2 presents the percentage distribution of fuel expenditures by household type according to the 2008 ENIGH. As the figure shows, the main consumers of fuels are rural and urban non-poor families (H4 and H8). Their expenditures account for 70 percent of total expenditures in diesel, gas, and other petrochemical products; 86 percent of total expenditures in gasoline; and 87 percent of total expenditures in natural gas. Figure 3 shows the calculated CO_2 emissions by household type, expressed in kilotons. The highest CO_2 emissions are related to non-poor families, in both rural (16 percent) and urban (65 percent) areas.

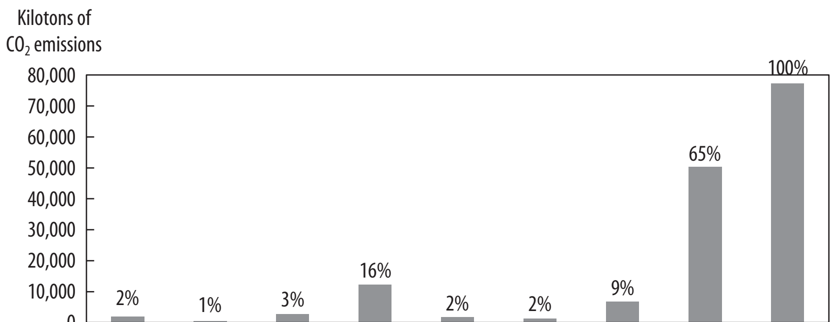
FIGURE 2. Distribution of Fuel Expenditures by Household Type in Mexico, 2008[a]



Source: Authors' calculations, based on the ENIGH household survey (INEGI, 2008).

a. Household types are defined as follows: H1: rural food poverty; H2: rural capabilities poverty; H3: rural patrimony poverty; H4: rural non-poor; H5: urban food poverty; H6: urban capabilities poverty; H7: urban patrimony poverty; and H8: urban non-poor.

FIGURE 3. CO_2 Emissions by Household Type in Mexico, 2008[a]



	H1	H2	H3	H4	H5	H6	H7	H8	Sum
CO_2 emissions	1,871	538	2,646	12,197	1,780	1,324	6,688	50,282	77,325

Household type

Source: Authors' calculations, based on the ENIGH household survey (INEGI, 2008) and Genty, Arto, and Neuwahl (2012).

a. Household types are defined as follows: H1: rural food poverty; H2: rural capabilities poverty; H3: rural patrimony poverty; H4: rural non-poor; H5: urban food poverty; H6: urban capabilities poverty; H7: urban patrimony poverty; and H8: urban non-poor. In the calculations, we excluded 193 kilotons of CO_2 emissions that were identified as nonenergy, since it was not possible to match these emissions in the fuel expenditure data from the 2008 ENIGH.

Vertically Integrated Effects

In general, energy suppliers are considered direct CO_2-intensive economic sectors, because their production processes involve the burning of fossil fuels. In Mexico, the electricity, gas, and water sector is the main direct emitter of CO_2, accounting for 29 percent of total emissions of CO_2. Next is oil byproducts (EA10), with 9 percent. In third place is mining, releasing 8 percent of the total (see figure 1 and table A3 in the appendix).

Other economic sectors indirectly contribute to CO_2 emissions, as the main energy users. To disaggregate pollutant emissions according to the final user of intermediate inputs with high embodied CO_2 emissions, we use vertically integrated effects. The vertical integration operator, denoted by *B,* is obtained as follows:[19]

$$\mathbf{B} = \mathbf{My}^{-1}\left(I - \mathbf{A}\right)^{-1}\mathbf{Mx}, \tag{1}$$

where **Mx** is a diagonal matrix that contains the final demand of the economic sectors; **A** is the technical coefficients matrix; and $\mathbf{My}^{-1}$ is a diagonal matrix, with the inverse of sectoral gross output as elements. The matrix of the vertically integrated CO_2 emissions ($\mathbf{MVIE}_{CO2}$) is obtained by pre-multiplying matrix **B** by $\mathbf{D}_{CO2}$. The latter is a diagonal matrix containing the CO_2 emissions of the economic sectors:

$$\mathbf{MVIE}_{CO2} = \mathbf{D}_{CO2}\mathbf{B}. \tag{2}$$

Therefore, the vertically integrated CO_2 emissions ($\mathbf{VIE}_{CO2}$), corresponding to economic sector *j,* are

$$\mathbf{VIE}_{CO2} = e'\mathbf{MVIE}_{CO2}, \tag{3}$$

where $\mathbf{VIE}_{CO2}$ is a vector of order $(1 \times n)$ that contains the CO_2 emissions embodied in the direct and indirect purchases of economic sector *j* from itself and from others. The direct CO_2 emissions of each economic sector *i* can be obtained as follows:

$$CO2' = \mathbf{MVIE}_{CO2}e. \tag{4}$$

19. Pulido and Fontela (1993).

Table A3 presents the matrix of vertically integrated CO_2 emissions. The cell in column *j* and row *i* can be interpreted as the CO_2 emissions linked to the purchase of intermediate inputs from economic sector *i* by economic sector *j* to supply the final demand of sector *j*. The sum of the elements of row *i* yields the total CO_2 emissions linked to the production of sector *i* through the sales of intermediate inputs made to all economic sectors *j* (CO_2 emissions). The sum of the elements of column *j* results in the total direct and indirect CO_2 emissions connected to the purchases of intermediate inputs made by economic sector *j* from all economic sectors *i* to supply its final demand. This is the vertically integrated effect of CO_2 emissions linked to the productive activity *j* (row **VIE**).

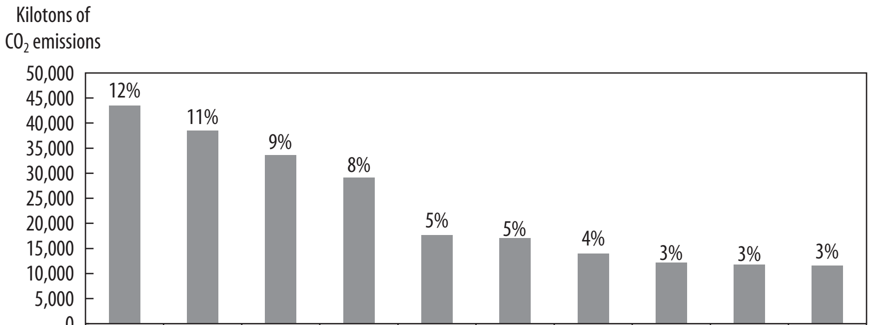
To provide an example of the methodology, we perform an analysis of one productive activity EA3, which corresponds to electricity, gas, and water. Through this input-output methodology, the emissions related to EA3 are disaggregated according to the economic sectors that employ electricity, gas, and water as an intermediate input. The economic sectors showing the highest CO_2 emissions related to EA3 include the electricity, gas, and water sector, with 36,449 kilotons (row and column EA3), followed by food, beverages, and tobacco, with 7,937 kilotons (row EA3 and column EA5), and construction, with 6,161 kilotons (row EA3 and column EA4).

The emissions linked to the intermediate inputs required to supply the final demand of electricity, gas, and water (vertically integrated CO_2 emissions) are 38,455 kilotons of CO_2, of which 36,449 kilotons are related to the purchase of intermediate inputs coming from that same activity (row and column EA3). In addition, 888 kilotons are related to the purchase of inputs from petroleum products (row EA10 and column EA3), and 384 kilotons are due to purchases from mining EA2 (row EA2 and column EA3).

The economic sectors linked to the largest vertically integrated CO_2 emissions are construction, with 43,517 kilotons (equivalent to 12 percent of the total); electricity, gas, and water, with 38,445 kilotons (11 percent); inland transport, with 33,557 kilotons (9 percent); food, beverages, and tobacco, with 29,514 (8 percent); and coke, refined petroleum, and nuclear fuel, with 17,675 kilotons (5 percent). See figure 4 and rows VIE and percent VIE in table A3 for more information.

In the case of construction (EA4), the CO_2 emissions embodied in the final product are related to intermediate inputs arising from other nonmetallic minerals (EA13), generating 13,160 kilotons; intermediate inputs supplied by the same sector, 11,953 kilotons; and the sector's consumption of electricity, gas, and water (EA3), 6,161 kilotons (table A3).

FIGURE 4. Economic Sectors with the Highest Vertically Integrated CO_2 Emissions in Mexico, 2008[a]



	EA4	EA3	EA22	EA5	EA10	EA2	EA14	EA1	EA20	EA13
VIE	43,517	38,445	33,557	29,154	17,675	17,072	14,016	12,139	11,745	11,583

Economic sector

Source: Authors' calculations, based on IOT 2008 (INEGI, 2012, 2014) and Genty, Arto, and Neuwahl (2012).

a. Sectors are identified as follows: EA4: construction; EA3: electricity, gas, and water supply; EA22: inland transport; EA5: food, beverages, and tobacco; EA10: coke, refined petroleum, and nuclear fuel; EA2: mining and quarrying; EA14: basic metals and fabricated metal; EA1: agriculture, hunting, forestry, and fishing; EA20: retail trade (excluding motor vehicles and motorcycles) and the repair of household goods; and EA13: other nonmetallic minerals.

The SAM-Based Multiplier Model

Since the seminal works of Stone and of Pyatt and Round, several studies have applied the SAM-based multiplier model to the structural and impact analysis of public policy.[20] In the last decade, many contributions have been made to environmental subjects, as mentioned in the introduction. In this paper, the model is specified to compute CO_2 emission multipliers for the Mexican economy. The CO_2 emission multiplier is interpreted as the CO_2 emissions linked to direct, indirect, and induced income generated by the exogenous injection of income in account *j,* where the account can be an economic sector, a factor of production, or a household type.

The SAM-based multiplier model is static. It is formulated by assuming fixed average expenditure propensities, fixed prices, or an economy with idle capacity and linear production. This last assumption means that intermediate products and the factors of production are complementary.

20. Stone (1985); Pyatt and Round (1979).

Economic sectors, households, labor types, and private capital are the accounts that are considered endogenous. The exogenous variables include the government, the rest of the world, and investments, since they can be used as economic policy instruments.

The SAM-based multipliers, $\mathbf{M}_C$, are obtained as follows:

$$\mathbf{Y}_n = \left(\mathbf{I} - \mathbf{A}_n\right)^{-1}\mathbf{X} = \mathbf{M}_C\mathbf{X}, \tag{5}$$

where n denotes the amount of endogenous accounts, $\mathbf{Y}_n$ is the vector of endogenous income (order $n \times 1$), $\mathbf{I}$ is the identity matrix (order $n \times n$), $\mathbf{A}_n$ is a matrix of average expenditure propensities (order $n \times n$), and $\mathbf{X}$ is a vector of exogenous income (order $n \times 1$). The element m_{ij} of the matrix $\mathbf{M}_C$ represents the overall income increase of the endogenous account i when the endogenous account j receives a unitary and exogenous income injection.

Consequently, the CO_2 emission multipliers are obtained as follows:

$$\mathbf{M}_{CO2} = \mathbf{CO2}\left(\mathbf{I} - \mathbf{A}_n\right)^{-1}, \tag{6}$$

where **CO2** is a row vector that contains the CO_2 emissions per unit of endogenous income, which is known as the intensity. The CO_2 emission multiplier of account j computes the CO_2 emissions linked to the increase in the economy's income when account j receives a unitary and exogenous income injection.

Table 2 contains the CO_2 emission multipliers, the direct CO_2 emissions effect (direct effect or intensity), and the indirect and induced CO_2 emissions effects (the difference between the multiplier and the direct effect) for each endogenous account for the Mexican economy. Figure 5 contains the endogenous accounts with the highest CO_2 emission multipliers.

The economic sectors with the highest CO_2 emission multipliers showing large direct effects are water transport; electricity, gas, and water supply; other nonmetallic minerals; air transport; and coke, refined petroleum, and nuclear fuel. For example, an exogenous injection of a billion pesos into the economic sector of water transport generates 297 kilotons of CO_2 emissions, where 249 kilotons are due to the direct effect and 48 kilotons are due to the indirect and induced effects (circular flow of income).

High CO_2 emission multipliers are due to the large indirect and induced effects that appeared in the following economic sectors: agriculture, hunting, forestry, and fishing; basic metals and fabricated metal; inland transport; hotels and restaurants; and wood and the products of wood and cork. Most of

TABLE 2. CO_2 Emissions Multipliers for the Mexican Economy, 2008
Kilotons per billion pesos

Account	*CO_2 emissions multiplier*	*Direct effect (intensity)*	*Indirect and induced effects*	*Account*	*CO_2 emissions multiplier*	*Direct effect (intensity)*	*Indirect and induced effects*
EA1	97	37	60	EA25	79	27	52
EA2	42	23	19	EA26	57	4	53
EA3	274	237	37	EA27	52	1	51
EA4	72	7	65	EA28	55	1	54
EA5	68	4	64	EA29	62	5	57
EA6	64	17	47	EA30	75	12	63
EA7	65	10	55	EA31	69	7	62
EA8	81	9	72	EA32	66	8	58
EA9	80	21	59	EA33	83	16	67
EA10	86	57	29	EA34	64	0	64
EA11	63	16	47	EA35	73	7	66
EA12	58	11	47	L1	69	0	69
EA13	200	129	71	L2	67	0	67
EA14	93	33	60	L3	63	0	63
EA15	45	7	38	K	50	0	50
EA16	30	10	20	H1	83	12	71
EA17	40	4	36	H2	79	9	70
EA18	66	24	42	H3	81	10	71
EA19	60	3	57	H4	67	7	60
EA20	67	9	58	H5	79	14	65
EA21	63	6	57	H6	78	12	66
EA22	89	26	63	H7	77	12	65
EA23	297	249	48	H8	61	8	53
EA24	153	78	75				

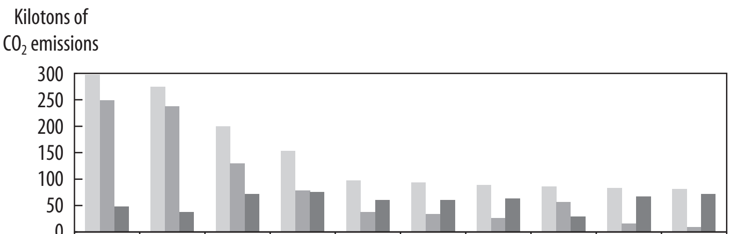
Source: Authors' calculations and Genty, Arto, and Neuwahl (2012).

these sectors are providers of goods or services to households. For example, an exogenous injection of a billion pesos into the economic sector of agriculture, hunting, forestry, and fishing generates 97 kilotons of CO_2 emissions, of which 37 kilotons are due to the direct effect and 60 kilotons are due to the indirect and induced effects.

Among the household types, the food poverty families in urban areas, H5, show the largest CO_2 emission multiplier (83 kilotons of CO_2 emissions). In contrast, non-poor families in urban areas present the smallest emission multiplier (61 kilotons). The indirect and induced effects represent the largest fraction of household CO_2 emission multipliers (between 80 percent and 90 percent) due to their role in the circular flow of income: households receive the income generated by factors of production, and they spend part of it on goods and services provided by economic sectors.

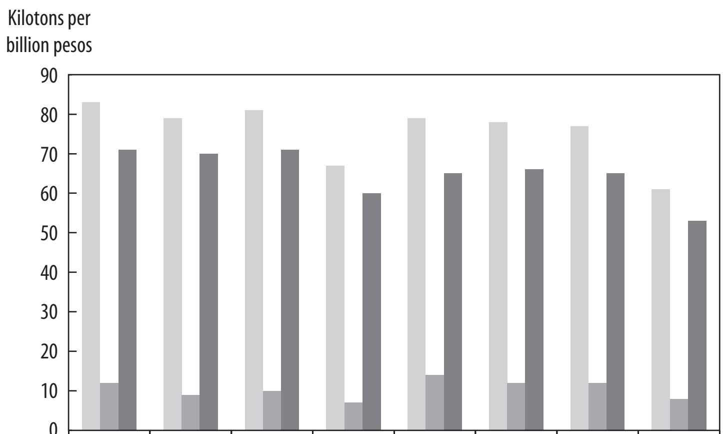
FIGURE 5. CO_2 Emissions Multipliers in Mexico, 2008[a]

A. Economic sectors



	EA23	EA3	EA13	EA24	EA1	EA14	EA22	EA10	EA33	EA8
Multiplier	297	274	200	153	97	93	89	86	83	81
Direct effect	249	237	129	78	37	33	26	57	16	9
Indirect and induced effects	48	37	71	75	60	60	63	29	67	72

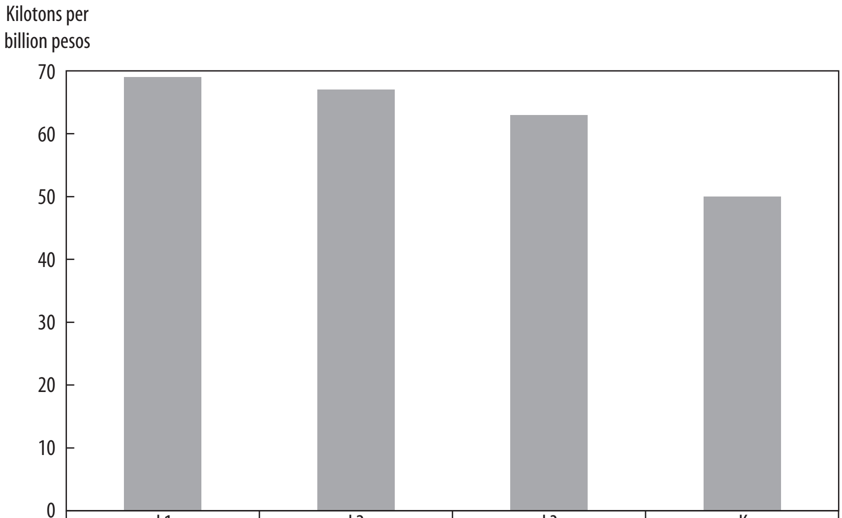
B. Household types



	H1	H2	H3	H4	H5	H6	H7	H8
Multiplier	83	79	81	67	79	78	77	61
Direct effect	12	9	10	7	14	12	12	8
Indirect and induced effects	71	70	71	60	65	66	65	53

FIGURE 5. CO_2 Emissions Multipliers in Mexico, 2008[a] *(Continued)*

C. Factors of production



	L1	L2	L3	K
Multiplier	69	67	63	50

Source: Authors' calculations, based on SAM Mexico 2008 and Genty, Arto, and Neuwahl (2012).

a. Sectors, households, education levels, and capital are defined as follows: EA23: water transport; EA3: electricity, gas, and water supply; EA13: other non-metallic minerals; EA1: agriculture, hunting, forestry, and fishing; EA24: air transport; EA14: basic metals and fabricated metal; EA22: inland transport; EA10: coke, refined petroleum, and nuclear fuel; EA33: hotels and restaurants; EA8: wood and the products of wood and cork; H1: rural food poverty; H2: rural capabilities poverty; H3: rural patrimony poverty; H4: rural nonpoor; H5: urban food poverty; H6: urban capabilities poverty; H7: urban patrimony poverty; H8: urban nonpoor; L1: less than complete secondary education (through ninth grade); L2: complete secondary (ninth grade) or incomplete high school (through twelfth grade); L3: complete high school or higher education; and K: private capital.

In addition, the higher the education level of the labor type, the lower the CO_2 emission multiplier becomes. This result may imply that the families with the highest income have consumption and income patterns that are less polluting than those of low-income families (figure 5). The factors of production are not direct CO_2 emitters; therefore, their CO_2 emission multipliers correspond to the indirect and induced effects.[21]

Conclusions

The structural analysis of CO_2 emissions by the Mexican economy provides information about the three sources of emissions: (i) the economic sectors that are direct CO_2 emitters, since they burn fuels to elaborate their products or to offer their services; (ii) the economic sectors that are the final users of these products or services, such that they are indirect CO_2 emitters and are thus also responsible for this pollution; and (iii) the economic sectors, factors of production, and household types that generate the largest CO_2 emission multipliers (direct, indirect, and induced effects) as a consequence of their role in the circular flow of income.

The highest direct emitters are gas and water supply; coke, refined petroleum and nuclear fuel; mining and quarrying; other nonmetallic minerals; and

21. There were three reasons to carry out this analysis using the information on CO_2 emissions published by the WIOD: (i) the results are comparable to results for other countries, since the calculation methodology is similar; (ii) we wanted to quantify emissions by households according to their poverty level, and the WIOD presents information on CO_2 by fuel linked to the intermediate consumption of economic sectors and household consumption; and (iii) in a future research project, we will use this SAM and the CO_2 emissions to calibrate a general equilibrium model for analyzing carbon tax effects, so we are only interested in CO_2 emissions linked to the burning of fossil fuels and not all GHG emissions. However, to test the results, we replicated the calculations using the GHG emissions by economic sector reported by Ruiz Nápoles (2012); these emissions were based on numbers from the National Inventory of GHG emissions (INEGEI). The results are available on request. While the absolute values are different, the ranking of economic sectors, production factors, and household types is similar. The Spearman correlation coefficients (SCC) and the corresponding *t*-student value indicate a strong correlation (with a significance level of 99 percent) both between the vertically integrated CO_2 emissions by economic sector calculated with the WIOD database and the vertically integrated GHG emissions computed with Ruiz's data (SCC = 0.9289), and between the CO_2 emission multipliers per account (that is, economic sectors, factors of production, and households) computed using the WIOD data and the GHG emission multipliers estimated with Ruiz's data (SCC = 0.7453). With respect to the emission multipliers, in the ranking results still hold. Poor households have larger GHG emission multipliers than nonpoor households. Similarly, jobs requiring a higher education show lower GHG emission multipliers.

inland transport. The final users of inputs that embody high levels of CO_2 emissions include construction; electricity, gas, and water supply; inland transport; food, beverages, and tobacco; and coke, refined petroleum, and nuclear fuel. Finally, the economic activities with the highest CO_2 emission multipliers are water transport; electricity, gas, and water supply; other nonmetallic minerals; air transport; and agriculture, hunting, forestry, and fishing.

Our findings suggest that a carbon tax could hurt poor families, since, in relative terms, these families generate more direct, indirect, and induced CO_2 emissions per unit of monetary income than non-poor families, as a consequence of their consumption patterns of fuels and the products that embody high CO_2 emissions levels (for example, agriculture, hunting, forestry, and fishing).

This research contributes to the discussion with its regressive thesis, which contrasts with earlier findings of progressive effects on welfare or non-redistributive effects.[22] In this sense, future research could be carried out to design a general equilibrium model to evaluate this policy option under flexible prices. These results could then be compared with the previous studies.

In recent years, efforts have been undertaken to update and improve environmental statistics in Mexico. Mexican environmental statistics are still scarce and lag behind international standards. In the near future, Mexico's environmental data are expected to match the quality and quantity of other countries. Hence, building a SAMEA (SAM and Environmental Accounts) will be feasible.

22. Boyd and Ibarrarán (2002); Ibarrarán, Boyd, and Moreno (2011); Bravo Pérez, Castro Ramírez, and Gutiérrez Andrade (2013).

Appendix: Social Accounting Matrix for Mexico, 2008

TABLE A1. Aggregate Structure of the Mexican SAM, 2008

Accounts	*EA*	*L*	*K*	*PK*	*H*
EA	Consumption of final goods used as inputs IOT 2008 $x_{EA,EA}$ (35×35)				Household consumption by final good IOT 2008 and ENIGH 2008 $C_{EA,H}$ (35×8)
L	Remunerations by labor type IOT 2008 and ENIGH 2008 $W_{L\cdot EA}$ (3×35)				
K	Gross operating surplus of private sector by economic sector IOT 2008 $GOS_{1,EA}$ (1×35)				
PK	Gross operating surplus of public sector by economic sector IOT 2008 and MIPS 2012 $GOS_{2,EA}$ (1×35)				
H		Labor income by household type ENIGH 2008 $W_{H,L}$ (8×3)			
CORP			Total gross operating surplus of private sector GOS_1 (1×1)		

CORP	*G*	*Priv S-I*	*Pub S-I*	*ROW*	*ChInv*	*Income*
	Government expenditure on final goods IOT 2008 G_{EA} (35 × 1)	Private gross fixed capital formation IOT 2008 $DPrI_{EA}$ (35 × 1)	Public gross fixed capital formation IOT 2008 and MIPS 2012 $DPuI_{EA}$ (35 × 1)	Exports IOT 2008 X_{EA} (35 × 1)	Change in inventories in domestic goods IOT 2008 NCh_{EA} (35×1)	Total utilization by final good IOT 2008 TQ_{EA}^{T} (35 × 1)
						Total remunerations by labor type W_{L}^{T} (3 × 1)
						Total private capital income GOS_1 (1 × 1)
						Total public capital income GOS_2 (1 × 1)
Net private capital rent by household type IOT 2008 and ENIGH 2008 NOS_H (8 × 1)	Government transfer to household type ISA 2012 and ENIGH 2008 $TR_{H,P}$			Remittances by household type ISA 2008 and ENIGH 2008 REM_H (8 × 1)		Total income by household type TI_H (8 × 1)
						Total income for private capital GOS_1 (1 × 1)

(continued)

TABLE A1. Aggregate Structure of the Mexican SAM, 2008 *(Continued)*

Accounts	*EA*	*L*	*K*	*PK*	*H*
G	Net taxes on production and compulsory employer contributions IOT 2008 $NTPN_{EA}$ (1×35) SBG_{EA} (1×35) Net taxes on products and import tariffs IOT 2008 and Presidencia 2009 $RNTPS_{EA}$ (1×35) MTG_{EA} (1×35)			Total gross operating surplus of public sector GOS_2 (1×1)	Direct taxes by household type IOT 2008 and ENIGH 2008 VAT_H (1×8) $RNTPS_H$ (1×8) $Itax_H$ (1×8) MTH_H (1×8)
Priv S-I					Household saving—rural and urban non-poor families are assumed to save at the same rate ISA 2008 S_H (1×8)
Pub S-I					
ROW	Imported inputs IOT 2008 M_{EA} (1×35)				Consumption expenditure on imported goods IOT 2008 and ENIGH 2008 HMG_H (1×8)
ChInv					
Expenditure	Total supply by final good IOT 2008 TQ_{EA} (1×35)	Total remunerations W_L (1×3)	Total gross operating surplus of private sector GOS_1 (1×1)	Total gross operating surplus of public sector GOS_2 (1×1)	Household expenditure TE_H (1×8)

Source: Authors' compilation.

a. The data sources are as follows: IOT 2008: Mexican input-output table for 2008 (INEGI, 2013); MIPS 201: Macroeconomic Indicators of the Public Sector (INE, 2014); ISA 2008: institutional sectors accounts from the Mexican national accounts (INE, 2014); ENIGH 2008: Household Income and Expenditure Survey (INE, 2008); Presidencia 2009: Presidencia de la República (2009).

CORP	*G*	*Priv S-I*	*Pub S-I*	*ROW*	*ChInv*	*Income*
Tax on private capital income ISA 2008 *CItax* (1×1)		Taxes on private fixed capital formation IOT 2008 $RNTPS_1$ (1×1) MTI_1 (1×1)	Taxes on public fixed capital formation IOT 2008 and MIPS 2012 $RNTPS_2$ (1×1) MTI_2 (1×1)			Total income of government *TIG* (1×1)
Consumption of fixed capital ISA 2008 FCC (1×1)				Foreign saving ISA 2008 *SROW* (1×1)		Total private saving *TPrS* (1×1)
	Public Saving ISA 2008 SG (1×1)					Total public saving *TPuS* (1×1)
Capital rent paid to foreigners KROW (1×1)	Imported final goods by government IOT 2008 GM (1×1)	Imported goods for private investment IOT 2008 *MPrI* (1×1)	Imported goods for public investment IOT 2008 *MPuI* (1×1)		Change in inventories in imported goods IOT 2008 ROWCh (1×1)	Total foreign sector income *TIROW* (1×1)
		Total change in inventories TChInv (1×1)				Total change in inventories TChInv (1×1)
Total income for private capital GOS_1 (1×1)	Total government expenditure *TEG* (1×1)	Total private investment *TPrInv* (1×1)	Total public investment *TPuInv* (1×1)	Total foreign sector expenditure *TEROW* (1×1)	Total change in inventories TChInv (1×1)	

TABLE A2. Social Accounting Matrix for the Mexican Economy, 2008

Billions of pesos

	EA1	*EA2*	*EA3*	*EA4*	*EA5*	*EA6*	*EA7*	*EA8*	*EA9*	*EA10*	*EA11*	*EA12*	*EA13*	*EA14*	*EA15*	*EA16*	*EA17*
EA1	51	0	0	0	265	2	0	12	0	0	2	2	0	0	0	0	0
EA2	1	5	4	20	0	0	0	0	0	409	122	0	15	49	0	0	0
EA3	10	10	4	9	25	5	1	1	6	1	8	6	9	24	1	4	6
EA4	0	3	1	120	0	0	0	0	0	0	0	0	0	0	0	1	0
EA5	42	0	0	0	135	0	4	0	0	0	1	0	0	0	0	0	0
EA6	1	0	0	1	1	22	1	0	4	0	0	1	0	0	0	0	4
EA7	0	0	0	0	0	0	5	0	0	0	0	0	0	0	0	0	2
EA8	0	1	0	12	1	0	0	4	0	0	0	0	0	1	0	2	1
EA9	1	0	0	2	7	1	0	0	31	0	5	1	2	1	1	4	1
EA10	11	14	56	31	17	1	0	1	3	9	10	1	12	5	1	2	1
EA11	17	28	65	20	17	7	1	1	6	4	153	28	8	12	1	2	4
EA12	1	0	0	20	22	0	2	0	1	0	5	3	0	1	1	9	18
EA13	0	3	0	102	14	0	0	0	0	0	1	0	14	1	0	2	3
EA14	0	9	0	129	6	0	0	0	0	7	2	1	2	130	21	28	45
EA15	0	1	0	3	0	0	0	0	0	0	0	0	0	1	3	1	3
EA16	0	0	0	17	0	0	0	0	0	0	0	0	0	0	0	10	1
EA17	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	62
EA18	0	0	0	5	0	1	0	0	0	0	0	0	0	0	0	1	0
EA19	13	8	13	47	50	6	2	1	8	7	28	6	6	27	5	10	36
EA20	12	8	13	46	49	6	2	1	8	7	28	6	6	26	5	10	35
EA21	4	2	4	18	15	2	1	0	2	2	8	2	2	8	2	3	10
EA22	4	3	6	17	16	2	0	1	2	7	14	3	2	9	2	4	14
EA23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
EA24	0	0	1	0	1	0	0	0	0	0	0	0	0	1	1	8	3
EA25	1	0	1	1	1	1	0	0	0	0	1	0	0	1	0	1	2
EA26	0	1	1	13	5	1	0	0	1	1	3	1	1	2	1	3	2
EA27	3	6	1	36	6	1	0	0	1	1	3	1	2	4	1	4	3
EA28	0	1	0	5	7	2	0	0	2	0	2	1	2	3	1	4	3
EA29	4	40	7	54	51	8	2	1	9	9	36	11	13	19	9	35	27
EA30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
EA31	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
EA32	0	1	0	3	1	0	0	0	1	0	1	0	1	1	0	1	1

EA33	0	2	1	7	1	0	0	0	0	0	2	0	0	1	0	2	2
EA34	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
EA35	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
L1	34	7	4	174	17	7	3	2	2	3	3	3	6	6	0	9	4
L2	14	8	6	126	22	9	2	2	5	2	7	4	5	9	4	16	15
L3	12	41	35	140	37	8	2	2	7	11	32	8	9	17	13	36	29
K	307	130	0	585	459	59	11	12	38	0	178	37	90	178	49	92	
H1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PK	0	870	200	2	0	0	0	0	0	63	26	0	0	0	0	0	0
G	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
OTrans	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ProTrans	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
EdTrans	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ROTrans	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SBG	4	4	3	28	5	2	0	0	1	1	3	1	1	2	1	4	3
VAT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
IT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NTPS	−4	−5	−21	−8	0	−3	−2	0	−1	2	−4	−1	−4	−3	−1	−5	−6
NTPN	1	1	2	7	3	1	0	0	1	6	3	1	1	3	0	1	2
Mtar	0	0	0	0	3	3	2	0	0	0	1	0	0	1	0	4	6
Priv S	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pub S	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Priv I	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pub I	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ROW	42	35	48	133	164	60	7	3	36	218	148	65	18	133	90	718	380
RemH	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ChInv	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sdisc	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sum	586	1,238	455	1,926	1,425	215	47	48	177	772	833	195	224	673	214	1,027	911

(continued)

TABLE A2. Social Accounting Matrix for the Mexican Economy, 2008 *(Continued)*
Billions of pesos

	EA18	*EA19*	*EA20*	*EA21*	*EA22*	*EA23*	*EA24*	*EA25*	*EA26*	*EA27*	*EA28*	*EA29*	*EA30*	*EA31*	*EA32*	*EA33*	*EA34*
EA1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
EA2	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
EA3	2	18	21	7	5	0	0	1	7	3	19	11	12	10	8	22	0
EA4	0	1	1	0	1	0	0	0	0	0	0	0	3	4	0	0	0
EA5	0	6	7	2	0	0	0	0	0	1	1	0	0	2	0	22	0
EA6	2	2	2	1	0	0	0	0	0	0	0	1	0	3	1	3	0
EA7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
EA8	7	3	3	1	0	0	0	0	0	0	0	0	0	0	0	0	0
EA9	1	6	7	2	1	0	0	0	1	9	5	13	2	3	2	2	0
EA10	1	4	4	4	189	0	31	1	6	0	14	8	1	3	4	4	0
EA11	4	4	4	2	3	0	0	0	2	0	3	3	1	16	6	6	0
EA12	3	6	7	2	1	0	0	0	0	0	0	1	0	1	0	2	0
EA13	1	1	1	1	0	0	0	0	0	0	1	0	0	0	0	1	0
EA14	9	2	3	1	0	0	0	0	0	0	0	1	0	0	2	0	0
EA15	0	1	1	0	2	0	0	1	0	0	0	0	0	0	0	0	0
EA16	0	1	1	0	0	0	0	0	7	0	0	0	0	0	1	0	0
EA17	0	3	4	2	13	0	2	0	3	0	0	0	0	0	0	0	0
EA18	1	1	1	0	0	0	0	0	0	0	0	1	1	2	1	2	0
EA19	3	12	0	2	18	0	2	1	6	2	2	4	1	5	2	4	0
EA20	3	0	14	2	17	0	2	1	6	2	2	4	1	5	2	4	0
EA21	1	2	3	6	11	0	1	0	2	2	1	2	0	4	1	1	0
EA22	1	2	2	1	8	0	1	1	2	1	1	3	1	3	1	1	0
EA23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
EA24	1	0	0	0	0	0	0	0	1	4	0	2	0	0	0	0	0
EA25	0	0	0	0	10	1	7	0	0	0	0	1	0	0	0	0	0
EA26	1	11	12	4	8	0	1	1	28	46	7	14	7	4	4	2	0
EA27	1	6	7	2	6	0	1	1	10	53	11	12	2	1	1	3	0
EA28	2	32	36	13	7	0	1	1	15	11	26	19	7	5	14	4	0
EA29	7	64	73	21	41	1	8	11	44	55	27	99	16	24	18	32	0
EA30	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0
EA31	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
EA32	0	1	1	1	1	0	0	1	2	5	2	3	1	3	3	3	0

EA33	0	2	2	1	4	0	1	0	2	2	0	4	3	2	1	0	0
EA34	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
EA35	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
L1	6	17	20	9	43	0	0	1	3	1	4	30	9	4	6	13	33
L2	8	30	40	15	73	0	0	3	11	5	3	55	17	13	7	20	15
L3	7	93	72	26	61	2	10	6	67	95	15	246	372	157	22	26	6
K	44	672	636	211	384	6	9	39	248	220	1,384	452	47	55	161	205	0
H1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PK	0	0	0	0	19	0	0	2	5	53	0	14	0	6	9	0	0
G	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
OTrans	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ProTrans	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
EdTrans	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ROTrans	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SBG	1	9	8	3	12	0	1	1	5	7	1	21	26	11	2	4	4
VAT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
IT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NTPS	0	−2	−2	−1	−71	0	−12	−1	−2	0	−6	−3	−1	−2	−2	−2	0
NTPN	1	3	3	1	−3	0	0	1	2	11	1	6	2	1	1	3	0
Mtar	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Priv S	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pub S	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Priv I	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pub I	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ROW	70	19	22	17	65	2	7	10	50	11	5	20	5	14	8	10	0
RemH	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ChInv	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sdisc	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sum	190	1,031	1,017	358	932	14	74	86	534	598	1,530	1,047	539	363	290	399	58

(continued)

TABLE A2. Social Accounting Matrix for the Mexican Economy, 2008 *(Continued)*
Billions of pesos

	EA35	*L1*	*L2*	*L3*	*K*	*H1*	*H2*	*H3*	*H4*	*H5*	*H6*	*H7*	*H8*	*PK*	*G*	*OTrans*	*ProTrans*
EA1	0	0	0	0	0	8	2	10	33	3	2	10	54	0	0	0	0
EA2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
EA3	16	0	0	0	0	4	1	6	35	2	2	11	92	0	0	0	0
EA4	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
EA5	3	0	0	0	0	42	15	71	273	25	22	99	539	0	0	0	0
EA6	1	0	0	0	0	2	1	4	21	1	1	5	54	0	0	0	0
EA7	1	0	0	0	0	1	0	2	7	0	0	2	16	0	0	0	0
EA8	0	0	0	0	0	0	0	0	1	0	0	0	2	0	0	0	0
EA9	7	0	0	0	0	1	0	2	7	1	1	3	15	0	2	0	0
EA10	17	0	0	0	0	7	3	14	68	5	5	22	134	0	0	0	0
EA11	15	0	0	0	0	7	2	11	67	3	3	16	163	0	0	0	0
EA12	0	0	0	0	0	1	0	1	13	0	0	1	24	0	0	0	0
EA13	0	0	0	0	0	1	0	1	14	0	0	1	27	0	0	0	0
EA14	1	0	0	0	0	1	0	2	11	0	0	3	23	0	0	0	0
EA15	0	0	0	0	0	0	0	0	1	0	0	0	2	0	0	0	0
EA16	0	0	0	0	0	0	0	1	8	0	0	1	26	0	0	0	0
EA17	0	0	0	0	0	1	0	3	17	4	5	18	137	0	0	0	0
EA18	1	0	0	0	0	2	0	2	14	1	0	3	34	0	0	0	0
EA19	7	0	0	0	0	22	10	14	109	8	9	41	288	0	0	0	0
EA20	6	0	0	0	0	1	0	6	131	2	1	15	339	0	0	0	0
EA21	4	0	0	0	0	1	1	2	47	0	1	4	125	0	0	0	0
EA22	4	0	0	0	0	19	8	40	177	15	13	64	320	0	0	0	0
EA23	0	0	0	0	0	0	0	0	1	0	0	0	6	0	0	0	0
EA24	2	0	0	0	0	0	0	0	4	0	0	0	25	0	0	0	0
EA25	1	0	0	0	0	3	1	3	11	0	0	1	26	0	0	0	0
EA26	22	0	0	0	0	2	1	6	61	2	3	17	224	0	0	0	0
EA27	21	0	0	0	0	1	1	1	61	0	0	4	292	0	2	0	0
EA28	7	0	0	0	0	4	2	10	89	32	23	109	1,028	0	0	0	0
EA29	31	0	0	0	0	0	0	1	15	0	0	2	67	0	16	0	0
EA30	0	0	0	0	0	2	1	4	22	2	1	9	84	0	411	0	0
EA31	0	0	0	0	0	2	1	5	27	1	1	5	81	0	240	0	0
EA32	4	0	0	0	0	4	1	5	48	2	2	9	170	0	6	0	0

EA33	18	0	0	0	0	6	2	13	70	5	4	23	213	0	0	0	0
EA34	0	0	0	0	0	0	0	0	7	0	0	1	50	0	0	0	0
EA35	0	0	0	0	0	0	0	0	1	0	0	0	1	0	656	0	0
L1	27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
L2	64	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
L3	333	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
K	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H1	0	23	10	3	93	0	0	0	0	0	0	0	0	0	0	10	2
H2	0	11	5	1	33	0	0	0	0	0	0	0	0	0	0	3	1
H3	0	42	27	15	129	0	0	0	0	0	0	0	0	0	0	9	2
H4	0	107	108	207	1,287	0	0	0	0	0	0	0	0	0	0	9	8
H5	0	22	19	11	67	0	0	0	0	0	0	0	0	0	0	2	0
H6	0	18	23	12	51	0	0	0	0	0	0	0	0	0	0	1	0
H7	0	82	103	87	255	0	0	0	0	0	0	0	0	0	0	2	0
H8	0	205	338	1,721	3,723	0	0	0	0	0	0	0	0	0	0	1	4
PK	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
G	0	0	0	0	0	0	0	0	0	0	0	0	0	1,275	0	0	0
OTrans	0	0	0	0	0	0	0	0	0	0	0	0	0	0	38	0	0
ProTrans	0	0	0	0	0	0	0	0	0	0	0	0	0	0	17	0	0
EdTrans	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10	0	0
ROTrans	0	0	0	0	0	0	0	0	0	0	0	0	0	0	158	0	0
SBG	27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
VAT	0	0	0	0	0	6	3	12	89	5	5	26	312	0	0	0	0
IT	0	0	0	0	373	−1	0	−1	31	−1	−1	0	326	0	0	0	0
NTPS	−7	0	0	0	0	0	0	0	−3	0	0	−1	−8	0	0	0	0
NTPN	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mtar	0	0	0	0	0	0	0	0	2	0	0	1	7	0	0	0	0
Priv S	0	0	0	0	1,098	0	0	0	186	0	0	0	619	0	0	0	0
Pub S	0	0	0	0	0	0	0	0	0	0	0	0	0	0	892	0	0
Priv I	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pub I	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ROW	14	0	0	0	76	8	3	14	86	7	6	29	275	0	146	0	0
RemH	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ChInv	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sdisc	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sum	658	512	636	2,057	7,185	157	61	267	1,863	126	113	556	6,213	1,275	2,593	38	17

(continued)

TABLE A2. Social Accounting Matrix for the Mexican Economy, 2008 *(Continued)*
Billions of pesos

	EdTrans	*ROTrans*	*SBG*	*VAT*	*IT*	*NTPS*	*NTPN*	*Mtar*	*Priv S*	*Pub S*	*Priv I*	*Pub I*	*ROW*	*RemH*	*ChInv*	*Sdisc*	*Income*
EA1	0	0	0	0	0	0	0	0	0	0	4	1	70	0	53	0	586
EA2	0	0	0	0	0	0	0	0	0	0	97	42	476	0	−3	0	1,238
EA3	0	0	0	0	0	0	0	0	0	0	0	0	7	0	0	0	455
EA4	0	0	0	0	0	0	0	0	0	0	1,219	565	0	0	0	0	1,926
EA5	0	0	0	0	0	0	0	0	0	0	0	0	85	0	27	0	1,425
EA6	0	0	0	0	0	0	0	0	0	0	0	0	73	0	2	0	215
EA7	0	0	0	0	0	0	0	0	0	0	0	0	8	0	1	0	47
EA8	0	0	0	0	0	0	0	0	0	0	0	0	4	0	1	0	48
EA9	0	0	0	0	0	0	0	0	0	0	0	0	19	0	5	0	177
EA10	0	0	0	0	0	0	0	0	0	0	0	0	64	0	−14	0	772
EA11	0	0	0	0	0	0	0	0	0	0	0	0	103	0	9	2	833
EA12	0	0	0	0	0	0	0	0	0	0	0	0	41	0	6	0	195
EA13	0	0	0	0	0	0	0	0	0	0	0	0	29	0	3	0	224
EA14	0	0	0	0	0	0	0	0	0	0	13	1	201	0	11	6	673
EA15	0	0	0	0	0	0	0	0	0	0	24	2	168	0	1	0	214
EA16	0	0	0	0	0	0	0	0	0	0	14	1	931	0	3	0	1,027
EA17	0	0	0	0	0	0	0	0	0	0	66	6	548	0	11	0	911
EA18	0	0	0	0	0	0	0	0	0	0	15	1	96	0	1	0	190
EA19	0	0	0	0	0	0	0	0	0	0	82	8	98	0	0	0	1,031
EA20	0	0	0	0	0	0	0	0	0	0	81	7	96	0	0	0	1,017
EA21	0	0	0	0	0	0	0	0	0	0	23	2	27	0	0	0	358
EA22	0	0	0	0	0	0	0	0	0	0	64	6	66	0	0	0	932
EA23	0	0	0	0	0	0	0	0	0	0	2	0	2	0	0	0	14
EA24	0	0	0	0	0	0	0	0	0	0	1	0	16	0	0	0	74
EA25	0	0	0	0	0	0	0	0	0	0	3	0	6	0	0	0	86
EA26	0	0	0	0	0	0	0	0	0	0	4	0	5	0	0	0	534
EA27	0	0	0	0	0	0	0	0	0	0	0	0	24	0	0	0	598
EA28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1,530
EA29	0	0	0	0	0	0	0	0	0	0	31	3	6	0	0	0	1,047
EA30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	539
EA31	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	363
EA32	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	290

EA33	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	399
EA34	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	58
EA35	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	658
L1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	512
L2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	636
L3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2,057
K	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7,185
H1	1	0	0	0	0	0	0	0	0	0	0	0	0	15	0	0	157
H2	1	0	0	0	0	0	0	0	0	0	0	0	0	6	0	0	61
H3	1	1	0	0	0	0	0	0	0	0	0	0	0	40	0	0	267
H4	5	19	0	0	0	0	0	0	0	0	0	0	0	112	0	0	1,863
H5	0	1	0	0	0	0	0	0	0	0	0	0	0	3	0	0	126
H6	0	1	0	0	0	0	0	0	0	0	0	0	0	6	0	0	113
H7	1	7	0	0	0	0	0	0	0	0	0	0	0	18	0	0	556
H8	3	127	0	0	0	0	0	0	0	0	0	0	0	91	0	0	6,213
PK	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1,275
G	0	0	207	457	725	–177	70	36	0	0	0	0	0	0	0	0	2,593
OTrans	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	38
ProTrans	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	17
EdTrans	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10
ROTrans	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	158
SBG	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	207
VAT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	457
IT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	725
NTPS	0	0	0	0	0	0	0	0	0	0	12	5	0	0	0	0	–177
NTPN	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	70
Mtar	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	36
Priv S	0	0	0	0	0	0	0	0	0	0	0	205	208	0	0	0	2,316
Pub S	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	892
Priv I	0	0	0	0	0	0	0	0	2,316	0	0	0	0	0	0	0	2,316
Pub I	0	0	0	0	0	0	0	0	0	892	0	0	0	0	0	0	892
ROW	0	0	0	0	0	0	0	0	0	0	386	36	0	0	48	0	3,770
RemH	0	0	0	0	0	0	0	0	0	0	0	0	291	0	0	0	291
ChInv	0	0	0	0	0	0	0	0	0	0	165	0	0	0	0	0	165
Sdisc	0	0	0	0	0	0	0	0	0	0	8	0	0	0	0	0	8
Sum	10	158	207	457	725	–177	70	36	2,316	892	2,316	892	3,770	291	165	8	

TABLE A3. Matrix of Vertically Integrated Effects for the Mexican Economy, 2008
Kilotons of CO_2 emissions

Economic activity	*EA1*	*EA2*	*EA3*	*EA4*	*EA5*	*EA6*	*EA7*	*EA8*	*EA9*
EA1	9,798	11	5	180	9,610	86	36	94	6
EA2	135	14,219	394	1,675	612	65	15	7	40
EA3	1,328	1,429	36,449	6,161	7,937	1,073	232	58	660
EA4	0	12	3	11,953	5	1	0	0	0
EA5	74	1	1	8	4,505	1	12	1	1
EA6	6	2	2	24	25	2,240	12	0	21
EA7	1	0	1	4	5	2	349	0	0
EA8	3	7	1	124	20	1	0	85	2
EA9	22	14	11	144	210	21	9	1	1,179
EA10	291	374	888	2,086	1,365	114	29	16	83
EA11	156	256	389	618	577	118	23	6	49
EA12	8	3	2	164	168	3	13	1	5
EA13	38	229	17	13,160	1,737	7	6	4	5
EA14	17	161	18	4,394	250	9	7	1	4
EA15	0	2	0	15	2	0	0	0	0
EA16	0	0	0	50	1	0	0	0	0
EA17	1	1	0	6	4	0	0	0	0
EA18	1	2	1	86	8	7	1	0	1
EA19	23	17	18	183	173	17	6	1	10
EA20	70	51	55	565	534	52	18	3	32
EA21	14	10	11	139	108	11	4	1	6
EA22	69	66	84	621	543	47	13	4	28
EA23	14	12	16	116	109	8	2	1	6
EA24	15	16	19	121	90	37	5	1	7
EA25	9	6	8	57	40	18	1	0	3
EA26	3	7	4	92	40	5	1	0	3
EA27	3	6	2	66	16	2	0	0	1
EA28	1	1	1	9	8	1	0	0	1
EA29	31	136	36	527	401	54	16	2	28
EA30	0	0	1	2	1	0	0	0	0
EA31	0	0	0	0	0	0	0	0	0
EA32	2	6	2	34	17	2	1	0	2
EA33	4	17	7	132	33	5	1	0	4
EA34	0	0	0	0	0	0	0	0	0
EA35	0	0	0	0	0	0	0	0	0
VIE	**12,139**	**17,072**	**38,445**	**43,517**	**29,154**	**4,009**	**817**	**287**	**2,185**
VIE (%)	3.4	4.8	10.9	12.3	8.3	1.1	0.2	0.1	0.6

Source: Authors' calculations and Genty, Arto, and Neuwahl (2012).

TABLE A3. Matrix of Vertically Integrated Effects for the Mexican Economy, 2008 *(Continued)*
Kilotons of CO_2 emissions

Economic sector	*EA10*	*EA11*	*EA12*	*EA13*	*EA14*	*EA15*	*EA16*	*EA17*	*EA18*
EA1	5	57	44	3	9	6	34	31	80
EA2	3,821	1,736	81	210	683	83	196	257	91
EA3	547	1,629	780	890	3,083	635	1,714	2,748	682
EA4	3	2	1	0	2	1	8	2	1
EA5	1	5	1	0	1	1	2	4	1
EA6	2	5	6	1	2	2	8	55	21
EA7	1	1	1	0	2	0	1	15	2
EA8	3	4	1	2	4	3	22	10	65
EA9	8	73	18	18	22	17	103	60	27
EA10	12,696	417	74	222	274	109	348	371	124
EA11	98	6,387	223	67	150	31	107	180	91
EA12	2	24	663	1	7	8	71	140	21
EA13	70	88	9	10,011	87	28	256	378	148
EA14	141	58	23	24	9,120	673	936	1,487	275
EA15	1	1	0	0	1	781	3	14	0
EA16	0	0	0	0	1	1	2,910	4	1
EA17	0	1	0	0	1	0	1	1,942	0
EA18	1	2	1	1	2	1	9	6	2,570
EA19	14	52	11	8	43	19	38	116	13
EA20	44	162	33	24	134	58	118	357	41
EA21	9	32	7	6	27	12	24	70	9
EA22	94	232	44	28	137	66	135	421	43
EA23	19	46	9	5	27	13	27	86	8
EA24	9	28	12	9	60	91	688	232	59
EA25	6	16	4	2	20	12	39	53	10
EA26	4	13	4	3	8	5	19	19	5
EA27	3	5	1	2	4	2	8	8	2
EA28	1	2	1	1	2	1	4	4	1
EA29	63	164	40	36	85	65	241	227	50
EA30	0	0	0	0	0	0	1	1	0
EA31	0	0	0	0	0	0	0	0	0
EA32	2	6	1	3	5	2	13	12	3
EA33	7	21	4	3	12	8	42	40	7
EA34	0	0	0	0	0	0	0	0	0
EA35	0	0	0	0	0	0	0	0	0
VIE	**17,675**	**11,271**	**2,094**	**11,583**	**14,016**	**2,733**	**8,126**	**9,351**	**4,454**
VIE (%)	5.0	3.2	0.6	3.3	4.0	0.8	2.3	2.6	1.3

(continued)

TABLE A3. Matrix of Vertically Integrated Effects for the Mexican Economy, 2008 *(Continued)*
Kilotons of CO_2 emissions

Economic sector	*EA19*	*EA20*	*EA21*	*EA22*	*EA23*	*EA24*	*EA25*	*EA26*	*EA27*
EA1	63	72	18	10	0	1	0	6	9
EA2	112	129	65	2,079	4	245	20	84	50
EA3	3,277	3,773	1,241	1,821	21	125	236	1,238	975
EA4	5	5	2	9	0	0	2	1	0
EA5	17	20	5	2	0	0	0	1	4
EA6	19	22	6	8	0	1	1	3	4
EA7	0	0	0	1	0	0	0	0	0
EA8	21	24	6	3	0	0	0	3	1
EA9	106	122	36	40	0	4	6	29	145
EA10	260	299	166	6,830	12	812	56	235	137
EA11	102	118	47	123	1	9	7	44	27
EA12	32	37	10	10	0	1	1	3	2
EA13	130	149	57	69	0	7	5	10	8
EA14	70	81	26	112	1	12	4	24	8
EA15	2	2	1	7	0	0	2	0	0
EA16	2	3	1	2	0	0	0	14	2
EA17	5	6	3	28	0	3	0	5	1
EA18	14	16	4	3	0	0	1	3	7
EA19	2,024	7	6	57	0	5	2	14	8
EA20	20	6,287	17	175	1	16	7	42	24
EA21	13	15	1,377	66	1	4	2	8	9
EA22	61	70	31	21,362	2	26	13	51	36
EA23	11	12	6	47	2,322	5	2	9	5
EA24	36	41	12	44	0	3,836	10	48	228
EA25	6	7	3	214	12	112	1,352	6	9
EA26	37	43	14	42	0	5	4	1,403	144
EA27	8	10	3	13	0	2	1	11	620
EA28	13	15	5	5	0	1	1	6	6
EA29	276	318	92	282	6	39	45	181	257
EA30	1	1	0	12	0	0	0	1	6
EA31	0	0	0	0	0	0	0	0	0
EA32	7	9	4	10	0	2	6	9	27
EA33	28	32	9	70	3	12	3	30	35
EA34	0	0	0	0	0	0	0	0	0
EA35	1	1	0	0	0	0	0	0	0
VIE	**6,779**	**11,745**	**3,273**	**33,557**	**2,388**	**5,286**	**1,788**	**3,521**	**2,793**
VIE (%)	1.9	3.3	0.9	9.5	0.7	1.5	0.5	1.0	0.8

TABLE A3. Matrix of Vertically Integrated Effects for the Mexican Economy, 2008 *(Continued)*
Kilotons of CO_2 emissions

EA28	*EA29*	*EA30*	*EA31*	*EA32*	*EA33*	*EA34*	*EA35*	*CO_2 emissions*	*CO_2 emissions (%)*
7	1	4	23	5	156	0	42	20,513	5.8
219	27	66	173	95	142	0	384	28,214	8.0
3,935	447	2,992	2,745	1,854	4,599	0	4,403	101,719	28.8
2	0	20	31	2	2	0	16	12,094	3.4
2	0	1	7	1	71	0	17	4,769	1.3
4	3	6	41	12	34	0	17	2,616	0.7
1	0	0	0	0	0	0	5	395	0.1
1	0	1	2	2	2	0	2	425	0.1
105	40	59	73	43	47	0	175	2,989	0.8
631	75	157	294	208	326	0	982	31,359	8.9
102	16	58	316	108	147	0	330	11,079	3.1
2	1	2	10	3	14	0	9	1,443	0.4
81	6	27	49	16	136	0	46	27,076	7.7
19	5	15	29	57	18	0	49	18,129	5.1
0	0	0	0	1	0	0	0	837	0.2
1	0	1	1	2	1	0	2	3,001	0.8
1	0	0	1	1	0	0	2	2,016	0.6
5	2	10	29	12	25	0	17	2,846	0.8
10	3	6	23	9	18	0	30	2,984	0.8
31	8	19	70	27	57	0	93	9,248	2.6
9	2	5	26	7	12	0	30	2,085	0.6
40	15	41	104	42	59	0	164	24,793	7.0
7	2	4	12	6	11	0	17	3,001	0.8
24	28	39	38	18	15	0	213	6,128	1.7
4	4	3	9	3	5	0	47	2,099	0.6
32	10	35	21	17	14	0	111	2,169	0.6
16	3	4	3	3	5	0	37	870	0.2
724	2	5	4	7	3	0	6	838	0.2
158	823	108	169	103	182	0	250	5,491	1.6
1	1	6,444	0	1	0	0	1	6,477	1.8
0	0	0	2,367	0	0	0	0	2,367	0.7
12	4	12	23	1,841	22	0	38	2,138	0.6
11	11	43	43	18	5,296	0	292	6,281	1.8
0	0	0	0	0	0	0	0	0	0.0
0	0	0	0	0	0	0	4,787	4,789	1.4
6,197	**1,539**	**10,189**	**6,738**	**4,522**	**11,420**	**0**	**12,618**	**353,280**	**100.0**
1.8	0.4	2.9	1.9	1.3	3.2	0.0	3.6	100.0	

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