A 2008 SAM and AGEM of Mexico and the case of taxes on hydrocarbons extraction

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ABSTRACT: This paper has three goals. First, to build and publish a transparent Social Accounting Matrix, based on the 2008 Input-Output Table of Mexico. Second, to develop a parsimonious Applied General Equilibrium Model (AGEM), which can be modified, and applied to other research purposes. And third, to apply this AGEM to the analysis of taxes on hydrocarbons extraction, given their importance for public budget and recent energy reforms. Specifically, we analyze an increase in Households Income Taxes that would collect the same amount of money, while we diminish taxes on hydrocarbons extraction. Our main results…

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Introduction.

In the first part of this paper, with information from the system of national accounts of Mexico, we build a Social Accounting Matrix (SAM). We start from the recent input-output table for 2008, prepared by the National Institute of Statistics and Geography of Mexico (INEGI), to systematize the economic data on productive sectors; and then, participation of households is disaggregated based on results from the national survey of income and expenditure of households in 2008 (ENIGH08, INEGI 2009). The information is complemented by several additional sources.

It is worth noting that the SAM is not only a database to carry out Applied General Equilibrium (AGE) analysis, but also a result in itself since it provides a comprehensive and detailed vision of the Mexican socio-economy and, more importantly, it is possible to apply a wide range of analytical methods to obtain a better understanding of the economy, and to inform policy design.

In the second part, we design an Applied General Equilibrium Model (AGEM), robust and parsimonious, of general application, i.e. in the same way that the MCS, the AGEM is also a result by itself which could be applied to a wide range of economic issues (environment, energy, trade, etc.), also useful for social and policy development.

Finally, in the third part we implement an application of the AGEM to the specific case of taxes on the extraction of hydrocarbons, of great socio-economic importance, given their high participation in the financing of public services such as education and health.

By the above, we consider that this work contributes substantially to generate (and to enable the generation of) knowledge about Mexican socio-economy to sustain social development and the construction of public policies of national scope. The paper ends with section 4, dedicated to our main findings and final comments.

1. Social Accounting Matrix of Mexico for 2008 (SAM-Mx08).

To build the SAM-Mx08, we follow the conceptual framework developed by scholars on the subject (Bellu 2012, Breisinger *et al.* 2010, Defourney and Thorbecke 1984, Keuning and

Ruijter 1988, Miller and Blair 2009, Muller et al 2009, 2011 and 2006, Santos Thiele and Piazolo 2002, Yusuf 2007, van de Steeg 2004). For the case of Mexico, we follow the work of Núñez (2008, 2004).

With respect to data, we start from the recent input-output table of Mexico for 2008, the domestic economy product-by-product to 19 sectors according to the North American Industry Classification System (NAICS, INEGI 2013), published in INEGI's site,[1] which we call IOT-Mx08; and develop the SAM with additional information from the Goods and Services Accounts (G&SA, INEGI 2010a), Institutional Sectors Accounts (ISA, INEGI 2010b), National Survey of Income and Expenditure of Households 2008 traditional (ENIGH08, INEGI 2009), and the 2008 Law of Income Tax.

1.1 construction of the MCS - Mx08.

To develop the SAM-Mx08 (in what follows the SAM) we follow as main criteria that of maintaining the structure of the economy implied by the IOT-Mx08 (in what follows the IOT), and that of achieving the greatest possible consistency with national accounts.

To begin, we reorganize the IOT data to clarify how the accounts are structured, particularly the structure of value added (VA) and taxes; table 1 presents the OIT rearranged with the columns of the productive sectors as a succession of concepts whose sum leads to the total gross output (at basic prices) of each sector. For illustrative purposes, we use a version aggregated to three sectors: we add the first 4 sectors into Sector1, manufactures are Sector2, and remaining sectors are lumped into Sector3. Then remuneration is disaggregated into the three components specified by the IOT: salaries and wages, effective social contributions, and other social benefits; Taxes on Production follow, and then the Gross Operating Surplus (GOS or Capital Rents). All figures are in millions of current 2008 pesos, unless otherwise noted.

With this reorganization, we can see production as a succession of added concepts. Let's consider the Sector1 column:

(a) The sum of inputs from the three sectors is the total for domestic inputs (1,243,426).

(b) Imports plus (net) taxes on goods and services plus the previous sum, amounts to total use for Sector1 (1,461,917).

[1] http://www3.inegi.org.mx/sistemas/tabuladosbasicos/tabniveles.aspx?c=33683 . As of March 12th 2015.

Table 1. MIP reorganized and added three productive sectors.

	Sector1	Sector2	Test3	**Intermediate consumption**	Private consumption	Public consumption	Gross investment	Export FOB	Statist. Discrep.	**Final Demand**	Total Uses
Sector1	237,728	981,884	176,254	**1,395,865**	277,150	34	1,978,310	553,776		**2,809,270**	4,205,135
Sector2	595,854	1,014,412	572,058	**2,182,324**	2,175,058	1,934	210,437	2,371,480	7,909	**4,766,818**	6,949,142
Sector3	409,845	873,668	1,391,970	**2,675,482**	4,860,909	1,330,536	316,007	345,355		**6,852,807**	9,528,289
Total Inputs Dom. Prodn.	**1,243,426**	**2,869,964**	**2,140,281**	**6,253,671**	**7,313,116**	**1,332,505**	**2,504,753**	**3,270,612**	**7,909**	**14,428,895**	**20,682,566**
Tot. Imports	257,277	2,109,683	280,821	**2,647,781**	429,813	1,302	470,528	148,829		**1,050,472**	3,698,252
G&S Tax	-38,786	-7,805	-113,494	**-160,085**	455,905	0	19,843	1		**475,749**	315,664
TotUses pc	**1,461,917**	**4,971,842**	**2,307,608**	**8,741,367**	**8,198,835**	**1,333,807**	**2,995,123**	**3,419,442**	**7,909**	**15,955,116**	**24,696,483**
Wages and salaries	518,046	330,861	1,943,428	**2,792,335**							
EfeSocBen	64,839	45,678	304,769	**415,285**							
OtrSocBen	55,199	53,558	94,918	**203,675**							
Tot. Remun.	**638,083**	**430,097**	**2,343,116**	**3,411,296**							
Prodn. Tax	10,936	22,160	36,795	**69,891**							
GOS	2,094,199	1,525,042	4,840,771	**8,460,012**							
GVA bp	**2,743,218**	**1,977,300**	**7,220,682**	**11,941,199**							
Tot. Prodn. basic prices	4,205,135	6,949,142	9,528,289	**20,682,566**							
GDP	2,704,432	1,969,495	7,107,188	**11,781,115**						475,749	12,256,864

Source: Compilation based on the MIP (INEGI, 2013).

(c) The sum of wages and salaries, effective social contributions and other social benefits, amount to total remunerations (638,083).

(d) Gross value added (GVA) equals total remunerations plus taxes on production plus Gross Operating Surplus (GOS) (2,743,218).

(e) Finally, total output (at basic prices) is equal to the sum of GVA plus total inputs (4,205,135). In a similar manner, we obtain total gross production for the rest of productive sectors.

(f) Turn now to the fourth column (intermediate consumption or inputs to production), which can be interpreted as an aggregation of sectors: In the last row the total GDP at basic prices, is precisely in the fourth column (11,781,115), and adding the total taxes on goods and services, we obtain GDP at market prices (12,256,864).

g) The columns of final consumption are kept just like they are in the IOT, but we aggregate gross fixed capital formation and changes in inventories, in a unique vector of gross investment.

(g) Once the IOT has been more conveniently reorganized, we proceed to use the conceptual framework referred to earlier, to get the scheme of table 2 (which we will refer to as the Macro-SAM), which consists, in principle, of 14 accounts: Companies,[2] Households, Government, Taxes on Goods and Services (G&S Tax), Taxes on Production (ProdnTax), Savings-Investment (SAV-INV), Capital, Labor, Effective Social Benefits (EfeSocBen), Other Social Benefits (OtrSocBen), the three Productive Sectors, and the Rest of the World (RoW).

In table 2, we see that the column for Households is that of Private Consumption in the IOT: G&S Tax (which include VAT), demand from productive sectors, and imports. The corresponding row contains income from Labor: Wages and Social Benefits.

Companies only have the Gross Operating Surplus (income from Capital rents) transferred from the Capital account.

[2] Companies are recorded as "Financial and Non-Financial Societies", in Mexico national accounts.

Table 2. IOT data into the scheme of the Macro SAM. Part 1

	House-holds	Compa-nies	Govern-ment	G&S Tax	Prodn Tax	SAV-INV	Capital	Labour	EfeSocBen
Households								2,792,335	415,285
Companies							8,460,012		
Government				315,664	69,891				
G&S Tax	455,905					19,843			
Prodn Tax									
SAV-INV									
Capital									
Labor									
EfeSocBen									
OtrSocBen									
Sector1	277,150		34			1,978,310			
Sector2	2,175,058		1,934			210,437			
Sector3	4,860,909		1,330,536			316,007			
RoW	429,813		1,302			470,528			
TOTAL	**8,198,835**	**0**	**1,333,807**	**315,664**	**69,891**	**2,995,123**	**8,460,012**	**2,792,335**	**415,285**

Table 2. IOT data into the scheme of the (macro) SAM. Part 2.

	OtrSocBen	Sector1	Sector2	Sector3	RoW	**Total row**	Total Column	**Difference**
Households	203,675					**3,411,296**	8,198,835	**-4,787,539**
Companies						**8,460,012**	0	**8,460,012**
Government						**385,556**	1,333,807	**-948,251**
G&S Tax		-38,786	-7,805	-113,494	1	**315,664**	315,664	**0**
Prodn Tax		10,936	22,160	36,795		**69,891**	69,891	**0**
SAV-INV							2,995,123	**-2,995,123**
Capital		2,094,199	1,525,042	4,840,771		**8,460,012**	8,460,012	**0**
Labor		518,046	330,861	1,943,428		**2,792,335**	2,792,335	**0**
EfeSocBen		64,839	45,678	304,769		**415,285**	415,285	**0**
OtrSocBen		55,199	53,558	94,918		**203,675**	203,675	**0**
Sector1		237,728	981,884	176,254	553,776	**4,205,135**	4,205,135	**0**
Sector2		595,854	1,014,412	572,058	2,371,480	**6,941,233**	6,949,142	**-7,909**
Sector3		409,845	873,668	1,391,970	345,355	**9,528,289**	9,528,289	**0**
RoW		257,277	2,109,683	280,821	148,829	**3,698,252**	3,419,442	**278,811**
TOTAL	**203,675**	**4,205,135**	**6,949,142**	**9,528,289**	**3,419,442**			

Source: Compilation with data of the IOT-Mx08 (INEGI, 2013).

The public sector has three accounts: Government, Taxes on Goods and Services (G&S Tax), and Production taxes (ProdnTax). The last two collect taxes from Households, and transfer them to the Government which, so far, only spend on goods produced by sectors and by the RoW (Column of Government consumption in the IOT).

Then we have the Savings-Investment account, which is gross investment we've got from the OIT. And the Capital account, which is simply the capital rents generated by the economy (Gross Operating Surplus, GOS) as defined in the Mexican System of National Accounts.

Total remunerations are also composed by three elements: Labor (wages and salaries), Efective Social Benefits (EfeSocBen), and Other Social Benefits (OtrSocBen), which are payments from productive sectors to workers; then these payments are transferred to the Households account.

Next we have productive sectors, which pay taxes, employ Capital and Labor, and buy inputs (domestic and imported) to generate production, which according to the IOT is distributed among intermediate demand (inputs) and final demand (private, public, investment and exports). Finally the RoW, obtains income from imports, and spends in exports.

Up to this point, we have not introduced any new data, but just reorganized the numbers in the OIT according to the square format of the SAM, whereupon it is possible to add the total per column and per row, and therefore to compare both: total revenues and total expenses.

The last column is the difference (income minus expenditure) for each account. Households, Companies, Government, Savings-Investment, and RoW, have non-zero differences because some elements are missing. For example, Households do not have income from Capital, not from transfers; on the other hand, Households are not paying income taxes, and they are not saving. Since all the information of the IOT has been already included into the macro SAM, in what follows we resort to the system of national accounts, and other sources, to complete and balance the SAM.

To begin with, we open a new account for Income Taxes (IncTax), and include the figures given by the Institutional Sectors Accounts (ISA, Inegi 2010), where Households

(and Non-Profit Institutions that Serve Households) pay income taxes of 351,023, and Companies 380,139. The total revenue, 731,163, is transferred to the Government account.

Also according to the ISA, Companies' gross savings equal 1,637,683; Government saves 492,324; Households 973,198; and RoW (174,277), then total savings amount to 3,277,481. The RoW pays 12,979 to documented Labor, and transfers of the RoW to households (remittances from Non-Documented Labor) are 282,176 (283,778 - 1,601). The Government pays to households *social benefits other than social in-kind transfers* (198,367), and *other net current transfers* (28,036), for a total of 226,403.

After we include this data in the SAM, opening at the same time another new account for Private Consumption (PrivCons), in which we place production for private consumption), we obtain a vector of differences between the total per row and the total per column, with a deficit for the Government of 935,815, a surplus in SAV-INV of 282,358, and a deficit for the RoW of 190,622.

The Statistical Discrepancy (SD) in Sector2 (Manufacturing) of 7,909 is only 0.1% of total manufacturing. On the other hand, the RoW has a deficit of 190,622, while the ISA report for the RoW 197,464 *Net Property Income* . Therefore, we assume that SD is an additional amount of exports by Sector2, paid by the RoW, then Sector2 gets balanced.

With regard to the public deficit of 935,815, it happens that the Government is not receiving the levy corresponding to the Other Taxes on Production (OTP), which for some reason in the IOT have been aggregated to the Gross Operating Surplus (GOS). To separate the OTP from GOS, we draw on Table 58 of the Goods and Services Accounts (G&SA, INEGI 2010), and subtract to obtain effective GOS and therefore OTP (Table 3).[3]

Table 3. Other taxes on production and gross operating surplus unbundling.

	Sector1	**Sector2**	**Sector3**	**Total**
GOS IOT	2,094,199	1,525,042	4,840,771	**8,460,012**
OTP G&SA	906,524	13,729	51,186	**971,440**
GOS SAM	1,187,674	1,511,313	4,789,585	**7,488,572**

Source: Compilation based on the IOT-Mx08 (INEGI, 2013) and G&SA (INEGI, 2010a).

[3] The GOS reported by G&SA is 7,468,149, then a non-explained difference of 20,423 would arise, but it is very small.

After inclusion of these additional data into the SAM under construction, the Government has a surplus of 35,625, thanks to the additional revenue from collection of the OTP. The RoW now has a deficit of 198,531, almost equal to its income from the net property (197,464). Then, we assume that the Government transfers its surplus to the RoW as Property Rent, and the rest (198,531 less 35,625) is covered by Companies (162,906). Therefore, the RoW and Government accounts are also already balanced.

Companies have now a surplus of 5,307,844 and, since them have covered all their expenses, said surplus is transferred to Households as capital rents. With these changes, as expected, the difference between Savings and Investment, which was spent not on capital goods (282,358), appears as a deficit in Households' spending, which would be absorbing an excessive quantity of produced goods and services.

To correct this difference, according to the criterion of maintaining the structure of the IOT, we adjust production for private consumption and investment, to the amounts given for such a difference, namely 7,030,759 (= 7,313,116 - 282,358) for private consumption, and 2,787,111 (= 2,504,753 + 282,358) for investment. Calculations are presented in table 4.

Table 4. Adjustment of investment and private consumption.

	Investment in IOT	Relative structure	**Adjusted Investment**	Private consumption in IOT	Relative structure	**Adjusted Private Consumption**
Sector 1	1,978,310	0.790	**2,201,322**	277,150	0.038	**266,449**
Sector 2	210,437	0.084	**234,159**	2,175,058	0.297	**2,091,079**
Sector 3	316,007	0.126	**351,630**	4,860,909	0.665	**4,673,230**
Total	**2,504,753**	**1,000**	**2,787,111**	**7,313,116**	**1,000**	**7,030,759**
Adjustment	282,358			282,358		
Adjusted total	2,787,111			7,030,759		

Source: Compilation based on the MIP (INEGI, 2013) and CByS (INEGI, a 2010).

With these changes, all the accounts in the SAM are balanced, but as an effect of the adjustments, in the productive sectors the following differences result: 212,312 for Sector 1, -60,256 for Sector 2, and -152, 056 for Sector 3.

In recent decades multiple methods for balancing matrices have been developed: from simple programs, such as that of Zenios *et al*. (1986) that minimizes a deviation function, to more sophisticated methods as the cross entropy approach by Robinson *et al.*

(2000) (also Debowics and Golan, 2012, Temurshoev and Miller, 2013), which are used to ensure that the data are adjusted to balance the matrix, under the fundamental idea that adjustment minimizes the change in the underlying structure to the economy.

In our case, we have arrived to differences relatively small (4.8%, - 0.87% and - 1.6% in the productive sectors), by which, and to maintain the transparency of the data and the consistency with the system of national accounts, we consider that a manual adjustment is the most appropriate.

The adjustment is made as follows: from investment in Sector1 we subtract the difference 212,312, with which this sector is balanced. Then, to keep total investment at the same level (given by gross savings of 3,277,481), we add the same amount to investment in the other two sectors, weighted by their relative weight: 84,868 and 127,444 respectively. Finally, private consumption in sectors 2 and 3 is adjusted by the resulting difference: 24,612.

The matrix thus obtained is already fully balanced, as shown in table 5.

Table 5. Balanced macro SAM-Mx08. Part 1

	Households	Companies	Government	IncTax	G&S Tax	ProdnTax	SAV-INV	Capital	Labor
Households			226,403						2,805,315
Companies								7,488,572	
Government				731,163	315,664	1,041,331			
IncTax	351,023	380,139							
G&S Tax	455,905						19,843		
ProdnTax									
SAV-INV	973,198	1,637,683	492,324						
Capital									
Labor									
EfeSocBen									
OtrSocBen									
Sector1			34				1,989,010		
Sector2			1,934				319,027		
Sector3			1,330,536				479,074		
PrivCons	7,030,759								
RoW	429,813	162,906	36,927				470,528		
TOT COL	**9,240,698**	**7,488,572**	**2,088,158**	**731,163**	**315,664**	**1,041,331**	**3,277,481**	**7,488,572**	**2,805,315**

Table 6. Balanced macro SAM-Mx08. Part 2

	EfeSocBen	OtrSocBen	Sector1	Sector2	Sector3	PrivCons	RoW	**TOT ROW**	TR - TC
Households	415,285	203,675					282,176	**9,240,698**	0
Companies								**7,488,572**	0
Government								**2,088,158**	0
IncTax								**731,163**	0
G&S Tax			-38,786	-7,805	-113,494		1	**315,664**	0
ProdnTax			917,461	35,890	87,981			**1,041,331**	0
SAV-INV							174,277	**3,277,481**	0
Capital			1,187,674	1,511,313	4,789,585			**7,488,572**	0
Labor			518,046	330,861	1,943,428		12,979	**2,805,315**	0
EfeSocBen			64,839	45,678	304,769			**415,285**	0
OtrSocBen			55,199	53,558	94,918			**203,675**	0
Sector1			237,728	981,884	176,254	266,449	553,776	**4,205,135**	0
Sector2			595,854	1,014,412	572,058	2,066,468	2,379,389	**6,949,142**	0
Sector3			409,845	873,668	1,391,970	4,697,842	345,355	**9,528,289**	0
PrivCons								**7,030,759**	0
RoW			257,277	2,109,683	280,821		148,829	**3,896,783**	0
TOT COL	**415,285**	**203,675**	**4,205,135**	**6,949,142**	**9,528,289**	**7,030,758**	**3,896,783**		

Source: Compilation.

1.2. Disaggregation of Households.

In order to elaborate a more complete and useful SAM for the analysis of economic issues, and in particular of public policies and their impact on the well-being of households, in this section we make a disaggregation of households, based on deciles as defined by the national survey of income and expenditure of households 2008 (ENIGH08, INEGI, 2009).

In table 6 we can see the income distribution in Mexico, according to the ENIGH08. The distance between the deciles with the highest and lowest revenue becomes immediately notable: decile X has more than 20 times more income than decile I, which gives account of the deep distributive gap that exists in Mexico. In what follows, we use the classification by decile of table 6.

Table 6. Households total quarterly income.

Decile of income *	Homes	Income
I	2,787,462	18,435
II	2,787,462	30,455
III	2,787,462	40,667
IV	2,787,462	51,263
V	2,787,462	62,052
VI	2,787,462	76,992
VII	2,787,462	96,135
VIII	2,787,462	122,046
IX	2,787,462	171,262
X	2,787,467	386,289
TOTAL	**27,874,625**	**1,055,594**

*****Households ordained into deciles according to quarterly total current income.
Source: National survey of income and expenditure of the households 2008. Traditional. Table 6.2. (INEGI, 2009).

We start breaking down private consumption and respective taxes, in table 7, the calculations are presented. We use the structure of the distribution of the *total current expenditure*, implied by data in table 7.2 of the ENIGH08, and distribute the consumption and taxes weighing participation in each decile.

Table 7. Breakdown of consumption and taxes on goods and services.

Income decile	Total current expenditure	Relative structure	Disaggregated Private consumption	Disaggregated tax
I	24,384	0.0302	212,216.0	13,761
II	34,468	0.0427	299,976.5	19,452
III	42,533	0.0526	370,161.7	24,003
IV	50,461	0.0625	439,157.2	28,477
V	58,693	0.0727	510,802.5	33,123
VI	68,721	0.0851	598,074.4	38,782
VII	78,467	0.0971	682,891.3	44,282
VIII	95,053	0.1177	827,236.0	53,642
IX	124,278	0.1538	1,081,582.3	70,135
X	230,803	0.2857	2,008,660.5	130,250
TOTAL	**807,862**	**1.0000**	**7,030,758**	**455,905**

Source: Compilation based on the MCS-Mx08 and table 7.2 of the ENIGH08 (INEGI, 2009).

Now, to disaggregate the Income Tax we use the provisions specified by the Law on Income Tax of 2008 (DOF, 2007), stipulated by article 113. Table 8 contains the provisions applicable. In table 9 we first calculate the tax paid by households with data from table 6.2 of the ENIGH08, and then distribute the taxes in the SAM on the resulting structure of relative participation.

Table 8. Income Tax on the monthly income of physical persons, 2008.

Lower limit (Pesos)	Upper limit (Pesos)	Fixed fee (Pesos)	Rate on surplus of the lower limit (%)
0.01	496.07	0.00	1.92
496.08	4,210.41	9.52	6.40
4,210.42	7,399.42	247.23	10.88
7,399.43	8,601.50	594.24	16.00
8,601.51	10,298.35	786.55	17.92
10,298.36	20,770.29	1,090.62	19.94
20,770.30	32,736.83	3,178.30	21.95
32,736.84	Hereinafter	5,805.20	28.00

Source: Law of the income tax. DOF 01-10-2007.

Table 9. Breakdown of Income Tax by decile. Part 1

	Total	**Decile I**	**Decile II**	**Decile III**	**Decile IV**	**Decile V**
Households	**27,874,625**	2,787,462	2,787,462	2,787,462	2,787,462	2,787,462
Quarterly total revenue (millions of pesos)	**1,055,594**	18,435	30,455	40,667	51,263	62,052
Total quarterly income per household (thousands of Mexican pesos)	**37.869**	6.613	10.926	14.589	18.390	22.261
Monthly income per household (pesos)	**12,623**	2,204	3,642	4,863	6,130	7,420
Lower limit		496	496	4,210	4,210	7,399
Fixed fee		9.52	9.52	247.23	247.23	594.24
Over on lower limit		1,708	3,146	653	1,920	21
Rate on the surplus		6.40	6.40	10.88	10.88	16.00
Income tax on the surplus		109.34	201.33	71.01	208.87	3.34
Total income tax paid	**18,567**	119	211	318	456	598
Relative structure	**1,000**	0.006	0.011	0.017	0.025	0.032
Income Tax SAM	**351,023**	2,247	3,986	6,016	8,623	11,298

Table 9. Breakdown of Income Tax by decile. Part 2

	Decile VI	**Decile VII**	**Decile VIII**	**Decile IX**	**Decile X**
Homes	2,787,462	2,787,462	2,787,462	2,787,462	2,787,467
Quarterly total income (millions of pesos)	76,992	96,135	122,046	171,262	386,289
Total quarterly income per household (thousands of Mexican pesos)	27.621	34.488	43.784	61.440	138.581
Monthly income per household (pesos)	9,207	11,496	14,595	20,480	46,194
Lower limit	8,602	10,298	10,298	10,298	32,737
Fixed fee	786.55	1,090.62	1,090.62	1,090.62	5,805.20
Over on lower limit	605	1,198	4,296	10,182	13,457
Rate on the surplus	17.92	19.94	19.94	19.94	28.00
Income tax on the surplus	108.48	238.83	856.69	2,030.22	3,767.88
Total income tax paid	895	1,329	1,947	3.121	9,573
Relative structure	0.048	0.072	0.105	0.168	0.516
Income Tax SAM	16,921	25,134	36,815	59,001	180,983

Source: Compilation.

We continue with the breakdown of the savings, using the same procedure followed for private consumption, but with the structure of the table 7.2 of the ENIGH08 *deposits to savings, batches, saving, etc.*

To end with Households' expenses, we disaggregate imports of households, based on the data of table 5.2 of the ENIGH08 *other miscellaneous expenses*, calculations are presented in table 10.

Table 10. Breakdown of direct imports by households.

Income decile	Other miscellaneous expenses	Relative structure	Imports of households SAM
I	92	0.0115	4,959
II	182	0.0228	9,791
III	167	0.0209	8,992
IV	170	0.0212	9,106
V	314	0.0392	16,865
VI	301	0.0376	16,149
VII	437	0.0546	23,450
VIII	927	0.1159	49,802
IX	1,442	0.1802	77,454
X	3,970	0.4961	213,246
TOTAL	**8,003**	**1.0000**	**429,813**

Source: Compilation.

We now proceed to disaggregate the elements of households' income. Starting with Labor, we use the relative structure implicit in the data in table 3.2 of the ENIGH08 to *pay for subordinated work*, we assume that these proportions are also applied to Social and Other Social benefits. Table 11 presents the estimates.

The following element is Government transfers, so we use data from table 3.3 of the ENIGH08 *benefits from government programs*, in the same way as before for Labor.

We still have the RoW transfers, so we use the *revenues from other countries*, of table 3.3 of the ENIGH08, to disaggregate in the same way as before, using the relative structure.

Table 11. Breakdown of payments to Labor.

Decile	Remuneration for subordinated work	Relative structure	Labout SAM	Social contributions SAM	Other social benefits SAM
I	4,195	0.0083	23,349	3,456	1695
II	11,072	0.0220	61,633	9,124	4,475
III	17,853	0.0354	99,374	14,711	7,215
IV	23,637	0.0469	131,570	19,477	9,552
V	30,840	0.0612	171,663	25,412	12,463
VI	40,412	0.0802	224,947	33,300	16,332
VII	52,761	0.1047	293,686	43,476	21,323
VIII	66,380	0.1317	369,493	54,698	26,826
IX	95,744	0.1900	532,943	78,894	38,693
X	161,086	0.3196	896,658	132,737	65,100
TOTAL	**503,979**	**1.0000**	**2,805,315**	**415,285**	**203,675**

Source: Compilation.

Finally, the deficit between what was spent by each household, and revenues so far distributed, is necessarily contributed by income from capital (GOS). Whereupon, the SAM-Mx08, with 19 productive sectors, ten representative households, prepared according the described procedure, is fully detailed and balanced (Appendix A).

2. Applied General Equilibrium Model of Mexico for 2008 (AGEM-Mx08).

This section describes the mathematical model. The equations of the model are specified, and then table 12 describes the parameters, and table 13 the variables.

2.1. The AGEM-Mx08 equations.

Following the order of the SAM, to specify the equations we start with Households, with 4 blocks of behavioral equations. Disposable income of each household is equal to its capital and labor income (put together effective social benefits and other social benefits to simplify), on which households pay income tax, then transfers from Government and from

the RoW complete their income. In what follows please refer to tables 12 and 13 for a detailed explanation of parameters and variables.

$$DISPINC_h = [\tau_{CAPHHh} * captotecon * P_{CAP} + \tau_{LABHHh}(labtotecon - LABRoW)P_{LAB}] \\ (1 - partinctaxhh_h)VARINCTAXHH + \beta_{TRGOVHHh} * TRGOVHH \\ +\beta_{TRRoWHHh} * TRRoWHH + \tau_{LABHHh} * LABRoW * P_{RoWIND} * ER \quad (1)$$

Out from their disposable income, households dedicate a proportion to save (Marginal Propensity to Save):

$$SAVHH_h = MPS_h * DISPINC_h , \ h = 1, 2,..., 10 \quad (2)$$

And the rest is destined to goods directly imported from the RoW, and goods from the domestic economy. Households have Cobb-Douglas preferences on imports and a composite good for private consumption. This composite good pays the tax on products (mainly VAT):

$$PRIVCONS_h = \frac{\alpha_{CONSPCh}[DISPINC_h - SAVHH_h]}{P_{PC}(1+\tau_h^{TPH})} \quad (3)$$

$$IMPHH_h = \frac{\alpha_{CONSMh}[DISPINC_h - SAVHH_h]}{P_{RoWIND} * ER} \quad (4)$$

We continue with Government, for which we define four variables for income and four for expenditures. The public fundraising total is the sum of revenues by Income Tax (Households and Capital), Taxes on products and production (Households and Activities), and Taxes on the import of capital goods:

$$GOBREV = REVINCTAX + REVPRODTAX + REVIMPINV \quad (5)$$

Total income tax revenue equals income tax from households plus that from firms:

$$REVINCTAX = \sum [\tau_{CAPHHh} * captotecon * P_{CAP} + \tau_{LABHHh}(labtotecon - LABRoW)P_{LAB}] * partinctaxthh_h * VARINCTAXHH + \tau_{INCTAXCAP} * captotecon * P_{CAP} \quad (6)$$

Revenue from taxes on products and production is the sum of taxes paid by Households, plus taxes on products and other taxes on production paid for Activities. We impute the taxes paid by the activities, including those of imports, to domestic production:

$$REVPRODTAX = \sum_h [PRIVCONS_h * P_{PC}]\tau_h^{PTH} + \sum_i [DOMPRODN_i * PDP_i]\tau_{PTi} \quad (7)$$

And revenues from imports of capital goods:

$$REVIMPINV = (INVIMPORT * P_{RoWIND} * ER)\ \tau^{IMPINV} \quad (8)$$

Regarding Government outlays, we assume that the policy is to allocate a fixed proportion of total collection, to each element of public expenditure:

$$TRGOVHH = \alpha_{TRGOVHH} * GOVREV \quad (9)$$

$$SAVGOV = \alpha_{SAVGOV} * GOVREV \quad (10)$$

$$PUBCONS_i = \frac{\beta_{PUBCONSi}(\alpha_{PUBCONS} * GOVREV)}{P_{TOTSUPi}} \quad (11)$$

$$IMPGOV = \frac{\alpha_{IMPGOV} * GOVREV}{P_{RoWIND} * ER} \quad (12)$$

$$SPVT = GOVTOTREV - TRGOVHH - SAVGOV - \sum_i PUBCONS_i * P_{TOTSUPi} - IMPGOV * P_{RoWIND} * ER \quad (13)$$

Now consider the savings-investment account. Total savings of the economy equal the sum of savings by each institution:

$$SAVTOT = \sum_h SAVHH_h + SAVGOV + deprec * P_{CAP} + SAVRoW * ER \quad (14)$$

The economy dedicates a fixed fraction of total savings to import capital goods, the tax is included in the price of imported capital goods:

$$INVIMP = \frac{\alpha_{INVIMP} * SAVTOT}{P_{RoWIND} * ER(1+\tau_{IMPINV})} \quad (15)$$

The block of equations corresponding to the macroeconomic closure that equals total savings to total investment is placed below, in the last section of equations, devoted to macro-closures.

We now turn to model the production of goods and services, assuming it is carried out in three stages: 1) production factors are combined to generate Value Added (VA), 2) total supply inputs are added to generate domestic production, and 3) imported inputs are added to domestic production to generate the total supply.

Consider the first nesting, generation of value added (VA), where there are two blocks of variables for the demands of factors and a block of prices for the VA generated by each Activity. Assuming a function of Cobb-Douglas production with constant returns to scale, and minimization of costs, we obtain the optimum demands:

$$DEMCAP_i = \frac{VA_i}{ascva_i}\left[\frac{P_{LAB}}{P_{CAP}}\frac{\alpha_{CAPi}}{\alpha_{LABi}}\right]^{\alpha_{LABi}} \quad (16)$$

$$DEMLAB_i = \frac{VA_i}{ascva_i}\left[\frac{P_{CAP}}{P_{LAB}}\frac{\alpha_{LABi}}{\alpha_{CAPi}}\right]^{\alpha_{CAPi}} \quad (17)$$

And assuming perfect competition (price equals average cost):

$$P_{VAi} * VA_i = DEMCAP_i * P_{CAP} + DEMTRAB_i * P_{LAB} \quad (18)$$

Similarly, for domestic production (*DOMPRODN*) there are three blocks of variables, one for the demand of VA, one for inputs, and the third for prices. Considering a Leontief combination, optimum demands are:

$$DEMINP_{i1,i} = DOMPRODN_i * ruii_{i1,i} \quad (19)$$

$VA_i = DOMPRODN_i * ruva_i$ (20)

And from the assumption of perfect competition:

$$P_{DPi1} * DOMPRODN_{i1} = P_{VAi1} * VA_{i1} + \sum_{i1} DEMINS_{i,i1} * P_{TSi1} \quad (21)$$

Now, for production of Total Supply (SUPTOT) we have three blocks of variables, one for domestic production demand, another one for imported inputs demand, and the third for prices. Also assuming a Cobb-Douglas production function, with constant returns to scale, from the problem of cost minimization, optimal demands are:

$$DOMPRODN_i = \frac{SUPTOT_i}{ascst_i}\left[\frac{P_{RoWIND}*ER}{P_{DPi}(1+\tau_i^{PT})}\frac{\alpha_{DPi}}{\alpha_{Mi}}\right]^{\alpha_{Mi}} \quad (22)$$

$$DEMIMP_i = \frac{SUPTOT_i}{ascst_i}\left[\frac{P_{DPi}(1+\tau_i^{PT})}{P_{RoWIND}*TC}\frac{\alpha_{Mi}}{\alpha_{DPi}}\right]^{\alpha_{DPi}} \quad (23)$$

And from the assumption of perfect competition:

$$P_{TSi} * SUPTOT_i = DOMPRODN_i * P_{DPi}(1+\tau_i^{PT}) + DEMIMP_i * P_{RoWIND} * ER \quad (24)$$

The block of variables of total supply is determined by the equilibrium condition of market clearing. We also place this block at the end, in the macro-closures section.

Total private consumption equals the sum of Households demands:

$$PRIVCONSTOT = \sum_h PRIVCONS_h \quad (25)$$

Then we define the price of the private consumption composite good, also given by the condition of unit price equal to the average unit cost:

$$P_{PC} = \sum_i P_{TSi} * rupc_i \;\; \sum P_{OTi}\, rucp_i \quad (26)$$

Finally there is the Rest of the World, whose equations are:

RoW revenues (at RoW prices):

$$RoWREV = [\sum IMPHH_h + IMPGOV + INVIMP]P_{RoWIND} + \sum DEMIMP_i\, P_{RoWIND} + dotcaprdm\frac{P_{CAP}}{ER} \quad (27)$$

RoW expenses (at RoW prices):

$$TRRoWHH = \alpha_{TRRoW} * RoWREV \quad (28)$$

$$SAVRoW = \alpha_{SAVRoW} * RoWREV \quad (29)$$

$$LABRoW = \alpha_{LABRoW} * RoWREV \quad (30)$$

$$EXP_i = \frac{\beta_{EXPi}(\alpha_{EXP} * RoWREV)}{P_{STi}/ER} \quad (31)$$

With respect to the RoW, we adopt the small country assumption, which implies that all the prices of the RoW will remain constant and equal to 1.

As for macroeconomic closures, the first two equations to close the model, are given by the equilibrium in factor markets:

$$\sum_i DEMCAP_i = captotecon \quad (32)$$

$$\sum_i DEMLAB_i = labtotecon - LABRoW \quad (33)$$

Then we have the basic closure for Savings-Investment: Marginal Propensity to Save (MPS) fixed, Investment flexible:

$$[SAVTOT - (INVIMP * P_{RoWIND} * ER)(1 + \tau^{IMPINV})]\beta_{INVi} = INV_i P_{STi} \quad (34)$$

Alternatively: fixed Investment, MPS flexible:

$$SAVHH_h = \left[\sum_i INV_i * P_{STi} + INVIMP * P_{RoWIND} * ER(1 + \tau^{IMPINV})\right]\tau_h^{savhh} - (SAVGOV + \tau^{deprec} * captotecon * P_{CAP} + SAVRoW * ER)\tau_h^{savhh}$$

Finally, the closure for the market of goods is:

$$SUPTOT_i = \sum_i DEMINP_{i1,i} * PRIVCONSTOT * rupc_i + CONSPUB_i + INV_i + EXP_i \quad (35)$$

Table 12. Parameters of the AGEM-Mx08.

Parameter	Description	Parameter	Description
FACTORS		INVESTMENT	
captotecon	Total capital in the economy	*Deprec*	Depreciation (firms savings)
trabtotecon	Total labor in the economy	τ_{DEPREC}	Depreciation rate
HOUSEHOLDS		$\alpha_{INVIMPORT}$	Share of imported capital in total investment (TotInv)
τ_{CAPHHh}	Share of Households (HH) in *captotecon*	α_{INVDOM}	Share of domestic capital in TotInv
$\tau_{LABHOGh}$	Share of HH in *trabtotecon*	β_{INVi}	Share of good *i* in domestic investment
$\beta_{TRGOVHHh}$	Share of HH in social transfers		
$\beta_{TRRoWHHh}$	Share of HH in RoW transfers	PRODUCTION	
MPS_h	Marginal propensity to save	α_{CAPi}	Share of capital in value added
τ_{SAVHHh}	Share per household in private savings	α_{LABi}	Share of labor in value added
$\tau o_{CONSCPh}$	Share of composite good in private consumption	$ascva_i$	Scale value-added parameter
τo_{CONSMh}	Share of imports in consumption	$ruii_{i1,\,i}$	Unit requirement of inputs
		$ruva_i$	Unit requirements of VA
GOVERNMENT		α_{DPi}	Share of domestic production in total supply
$\tau_{INCTAXHH}$	Rate of income tax of HH	α_{Mi}	Share of imports in total supply
VARINCTAXHH	Sum of HH income tax rates	$ascts_i$	Total supply scale parameter
$partinctaxhh_h$	Share of HH in *VARINCTAXHH*	$rupc_i$	Unit requirement for composite good
$\tau_{INCTAXCAP}$	Firms' income tax rate		
τ_{PTHh}	Private consumption-tax	RDM	
τ_{PTi}	Tax on production	*Dotcaprow*	Endowment of capital of the RdM
τ_{IMPINV}	Tax on capital imports	τ_{CAPRoW}	Share of RoW in *captotecon*
$\alpha_{TRGOVHH}$	Share of Transfers in Gov't Expenditure (GovExp)	τo_{LABRoW}	Share of labor in RoW spending
α_{SAVGOV}	Share of Savings in GovExp	$\beta_{TRRoWHH}$	Share of remittances in RoW spending
α_{IMPGOV}	Share of Imports in GovExp	α_{SAVRoW}	Share of savings in RoW spending
$\alpha_{PUBCONS}$	Share of Consumption in GovExp	α_{EXP}	Share of exports in RoW spending
$\beta_{PUBCONSi}$	Share of good *i* in Government consumption	β_{EXPi}	Share of good *i* in exports

Source: Compilation.

Table 13. Endogenous variables of the AGEM-Mx08. part 1.

HOUSEHOLDS	**Subtotal**	**50**
	Real variables	
Private household consumption	$CONSPRIV_h$	10
Imports for home	$IMPORTHOG_h$	10
	Nominal variables	
Disposable income per household	$DISPINC_h$	10
Each household saving	$AHRHOG_h$	10
Marginal propensity to save	$PMAHOG_h$	10
GOVERNMENT	**Subtotal**	**28**
	Real variables	
The Government imports	*IMPORTGOB*	1
Government consumption	$CONSPUB_i$	19
	Nominal variables	
Revenue from Income tax	*REVINCTAX*	1
Revenue from products tax	*REVPRODTAX*	1
Revenue from capital imports	*REVIMPINV*	1
Government total revenues	*INGGOB*	1
Government transfers to households	*TRGOVHH*	1
Public savings	*SAVGOV*	1
Government surplus	*SPVTGOV*	1
Variable for income tax of households	*VARINCTAXHH*	1
SAVINGS-INVESTMENT	**Subtotal**	**21**
	Real variables	
Investment in imported capital	*INVIMPORT*	1
Investment in national capital	INV_i	19
	Nominal variables	
Total savings in the economy	*AHRTOT*	1

Table 13. Endogenous variables of the AGEM-Mx08. Part 2.

PRODUCTION	**Subtotal**	**536**
	Real variables	
Demand for capital by activity	$DEMCAP_i$	19
Demand for labour by activity	$DEMTRAB_i$	19
Value added by activity	GO_i	19
Demand for inputs by activity	$_{I1,\,i}\,DEMINS$	361
Domestic product by activity	$PRODNINT_i$	19
Demand for imports by activity	$DEMIMPORT_i$	19
Offer total per activity	$OFTOT_i$	19
Total private consumption	CONSPRIVTOT	1
	Prices	
Price of Capital	P_{CAP}	1
Price of the work	P_{TRAB}	1
Price from value added	P_{Vai}	19
Price of domestic production	P_{IIP}	19
The total offer price	$P._{Oti}$	19
The private consumer goods price	P_{CP}	1
REST OF THE WORLD	**Subtotal**	**25**
	Real variables	
Work contracted by RoW	*LABRoW*	1
Exports by Activity	$EXPORT_i$	19
	Nominal variables	
Income of the RdM	*INGRDM*	1
RoW transfers to Households	*TRRoWHH*	1
Savings of the RoW	*SAVRoW*	1
	Prices	
Exchange rate	*TC*	1
Price index of the RdM	*PRDMIND*	1
	TOTAL	**660**

Source: compilation.

3. Analysis of taxes on hydrocarbons extraction.

According to the IOT-Mx08, taxes paid by sectors, and total production, are presented in table 14. The *Other taxes on production (OIP)*, from table 58 of the Accounts of Goods and Services (AG&S), where it is seen that *Other taxes on the extraction of oil and gas* (901,548.6), are 99.9% of the *Other taxes on mining*. The global tax rate, in the penultimate column, is calculated by dividing total taxes by production at basic prices. In the last column the tax rate by sector is calculated, with data obtained for the MCS-Mx08, dividing total taxes by domestic production net of taxes.

Table 14. Taxes on productive sectors.

SEC-TOR	TOTAL PRODUC-TION Basic prices	Net Taxes on goods and services	Net production taxes	Other net production taxes	Total taxes	GLOBAL TAX % IOT-Mx08	GLOBAL TAX % SAM-Mx08
A1	586,319	-3,624	1,465	160	-1,999	-0.34	-4.8
A2	**1,238,359**	**-5,351**	**827**	**902,563**	**898,040**	**72.52**	**172,5**
A3	454,744	-21,393	1,813	1,424	-18,157	-3.99	15.4
A4	1,925,713	-8,418	6,831	2,378	792	0.04	4.0
A5	6,949,142	-7,805	22,160	13,729	28,085	0.40	0.6
A6	2,332,613	-4,911	6,711	12,397	14,197	0.61	3.0
A7	1,152,579	-84,204	-1,020	-1,443	-86,668	-7.52	-10.7
A8	487,363	-1,469	2,108	2,457	3,096	0.64	-6.8
A9	598,298	-384	10,960	9,591	20,166	3.37	-2.0
A10	1,615,425	-6,816	1,448	10,648	5,279	0.33	21.4
A11	402,904	-1,336	1,271	1,321	1,256	0.31	-8.1
A12	84,260	-330	592	5,576	5,838	6.93	56.2
A13	475,101	-634	3,582	1,430	4,378	0.92	0.8
A14	539,239	-841	1,723	1,948	2,830	0.52	-8.1
A15	362,835	-1,505	1,392	1068	955	0.26	-18.3
A16	74,044	-317	519	391	593	0.80	18.3
A17	399,154	-1,816	2,502	1,573	2,260	0.57	3.4
A18	346,327	-2,077	971	866	-241	-0.07	-6.4
A19	658,148	-6,852	4,036	3,364	548	0.08	-0.4
TOTAL	**20,682,566**	**-160,085**	**69,891**	**971,440**	**881,247**	**4.26**	**11.59**

Source: Compilation with data of the MIP-Mx08 and CByS (INEGI, a 2010).

According to the IOT Mining pays a total rate of 72.5%, and the following sector that pays the highest rate is A12 (Firms management) with 6.9%. Then, all other activities have rates lower than 3.5% and negative; and the average is 4.26%. According to SAM's data in last column, Mining pays a global tax of 172.5%; and the average amounts to 11.59%.

Table 15 shows the income tax rate paid by households according to the SAM-Mx08, which goes from 1.1% on the poorest decile, to 6.2% on the richest one.

The simulation we implement reduces the total tax rate paid by Mining (hydrocarbons extraction) down to the average level of 11.59%, compensating with a uniform increase to income tax paid by households, so that (nominal) global revenue remains at the same level.

3.1 Macroeconomic closure

Since effects on households' wellbeing are a major concern for this research, we use Hick's Equivalent Variation (HEV) to evaluate changes in monetary terms. In order to compute a sensible HEV we set the following macro-closures combination: a) fixed real investment with flexible households savings (MPS_h), to prevent fluctuations in investment to bias the HEV; b) fixed total government revenues and flexible Income Tax on Households, so that Government maintains the level of spending, and the welfare of households is not affected by the change in the consumption of public goods; c) by the same token, fixed RoW income (and therefore fixed RoW savings) and flexible exchange rate.

3.2. Simulation results.

The implementation of the described simulation shows that reducing the tax on Mining (extraction of hydrocarbons) from 172.5 to 11.59%, to keep constant total government revenue would triple the income tax paid by households. The resulting simulation rates are also in table 15, the penultimate column results from dividing the final rate by the initial.

Table 15. Rate of income tax paid by taxpayers according to the MCS-Mx08.

Taxpayer	Initial income tax rate (SAM-Mx08)	Final income tax rate (After simulation)	Final rate / initial rate	HICKS' EQUIVALENT VARIATION
Decile I	0.011	0.034	3.08	6.5358
Decile II	0.014	0.043	3.06	4.4743
Decile III	0.016	0.050	3.07	3.8506
Decile IV	0.019	0.057	3.07	2.8795
Decile V	0.021	0.063	3.06	-0.0183
Decile VI	0.025	0.076	3.06	-2.3725
Decile VII	0.032	0.098	3.06	-16.0101
Decile VIII	0.036	0.111	3.07	-26.6316
Decile IX	0. 041	0.127	3.07	-43.4359
Decile X	0.062	0.189	3.07	-201.4302
TOTAL				**-272.1584**

Source: Compilation.

In the last column are Hicks' Equivalent Variations, showing that lower income deciles are benefited, while from decile V on, households begin to have a negative HEV, due to the progressive income tax; if we sum up all ten of them, we obtain a negative total of (-272.1584) which accounts for total welfare loss in monetary terms.

This negative effect obeys primarily to the fact that with this reform, households have to pay for public services which were financed with taxes on Mining and, although a positive effect is observed through a fall in prices, this is much smaller and surpassed by far by the negative effect.

Table 16 contains the prices resulting from the simulation, which decrease more or less depending on the degree of integration of each sector with Mining. The price of labor increases slightly (0.1%) and final consumption prices decrease by 3.5%.

By construction the AGEM-Mx08 is a model of perfect competition, (although in this case Pemex is a monopoly, the small country assumption implies that it can't modify international oil prices), therefore price formation occurs from costs and taxes, hence, to lower taxes in Mining reduce its prices, which in turn lowers prices in other sectors, which would improve the competitiveness of the Mexican economy.

Table 16. Final prices obtained through simulation.

Activity	Price	Activity	Price	Activity	Price
A1	0.980	A7	0.975	A13	0.995
A2	**0.411**	A8	0.987	A14	0.997
A3	0.956	A9	0.994	A15	0.988
A4	0.968	A10	0.996	A16	0.991
A5	0.909	A11	0.995	A17	0.985
A6	0.993	A12	0.995	A18	0.989
				A19	0.989

Source: Compilation.

According to the simulation, the mining sector prices decrease in 59% (but as we said, international markets could prevent oil prices from decreasing), consequently, prices in other sectors decreasing from 0.3% in activity 14 up to 9.1% in activity 5 (which uses more imputs from the mining sector).

4. Final comments.

The first goal of this research was to build a Social Accounting Matrix of Mexico for 2008 (SAM-Mx08), fully transparent and documented, which we consider to be a relevant achievement in itself, providing a complete view of the Mexican economy and enabling the application of a wide range of analytical methods (Breisinger, Marcell, and Thurlow, 2010).

We believe that transparency is an essential criterion, which will allow that, results from investigations carried out with the SAM database, can be replicated by other researchers and discussed with sufficiency, to arrive at a solid and useful conclusions. Moreover, the SAM can be corrected and/or modified to do further studies. In addition, the SAM can be immediately broken down to the next level of the North American Industry Classification System (NAICS) with 79 subsectors (INEGI, 2013), and even to the level of 262 branches, which enables a more detailed and comprehensive understanding of the economy.

To build the SAM, we assumed some simplifications to reconcile inconsistencies between the IOIT and the National Accounts; while it is commendable that INEGI has

restarted the five-year development of the IOT for Mexico, it is also desirable that data in future editions be properly reconciled, so that the information is reliable and consistent for the public and private decision-making, and to enable scholars to perform deeper and comprehensive economic investigations. INEGI might also consider the elaboration of a comprehensive SAM at least at the national level, and generate the necessary data so that researchers can build OITs and SAMs at the state and other regional levels.

The second objective was to develop a, robust and parsimonious, Applied General Equilibrium Model of Mexico for 2008 (AGEM-Mx08) based on the SAM-Mx08. In this we also believe that transparency is essential, because only the replication of results by other researchers and reasoned discussion will lead to valid and useful results. Therefore, both the SAM and the GAMS code for the AGEM, will be provided by the author upon request.

In the same way that with the SAM, the AGEM-Mx08 may also be corrected or modified to apply it to the study of other problems, since we believe that its parsimony and robustness, allow it to serve as a base or starting point for models more complex and more sophisticated simulations. The range of possibilities is wide: analysis of reform of VAT, effects of changes in public spending policies, evaluate programs to alleviate poverty, international trade, etc.

The third objective was to apply the AGEM to a problem of high current interest in the Mexican economy and public finances: taxes on the extraction of hydrocarbons, with a simulation which is a first approach to a complex problem, and requires additional developments, among others: a) A more elaborated specification of the functions of production and price formation, particularly in the extraction of hydrocarbons; (b Use of alternative closures and discussion of its implications on the results; and c) a more detailed assessment of impact on finances and spending, and their consequences for the welfare of households.

Results from the simulation we implemented, indicate that even though low-income households would have a slight benefit when reducing the taxes paid by the extraction of hydrocarbons and compensating with an equivalent increase in Income Taxes, households with higher incomes would have to absorb the financing of public expenditure, incurring a high cost. In addition, part of the benefit is derived from the decrease of prices (more than 50%) in the Mining sector, however it isn't clear how this would happen, in a scenario in

which the oil income is very high and prices are set from the outside, then it is possible that the improvement in wellbeing and competitiveness wouldn't happen because oil prices in fact would not fall to that extent. To clarify these issues requires the continuation of the work in the sense above noted.

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