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An applied general equilibrium analysis of fiscal reforms to fight poverty in Mexico[1][2]

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Abstract

The main goal of this paper is to analyze the consequences of two alternative ways of raising funds to finance poverty alleviation programs in Mexico: A Value Added Tax (VAT) reform and a personal income tax reform (IT). The impact of the reforms is analyzed with an applied general equilibrium model of the Mexican economy, calibrated using a 1996 Social Accounting Matrix. The model includes 18 production sectors, 10 representative households, the government, and the rest of the world. The cash transfers required to attain a fixed increase in the Equivalent Variation (EV) of the lowest income households are obtained either increasing effective VAT rates or IT rates. When all rates are scaled up by the same factor, the VAT reform generates a positive global EV considerably larger than the one obtained scaling the IT rates, though the latter diminishes (increases) lower (higher) income households' contribution. Setting a uniform VAT rate results in a positive global EV considerably larger than the one obtained with a uniform IT. Moreover, the distribution gap increases in the latter case since the richest households receive the largest benefits.

Key words**:** poverty alleviation, tax reforms, social accounting matrix, applied general equilibrium, equivalent variation.

Resumen

El objetivo de este artículo es analizar las consecuencias de dos formas alternativas de recaudar fondos para financiar los programas de alivio a la pobreza en México: la reforma del Impuesto al Valor Agregado (IVA) y la reforma del Impuesto Sobre la Renta (ISR). El impacto de las reformas se

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analiza con un modelo de equilibrio general aplicado de la economía mexicana que ha sido calibrado sobre una matriz de contabilidad de 1996. El modelo incluye dieciocho sectores productivos, diez hogares representativos, el gobierno y el resto del mundo. Las transferencias directas necesarias para alcanzar un incremento fijo en la variación equivalente (VE) de los hogares de menores ingresos, se obtienen mediante el incremento a la tasa del IVA, o bien la del ISR. Cuando las tasas son escaladas por el mismo factor, la reforma del IVA genera una VE global positiva, considerablemente mayor que la que se obtiene escalando las tasas del ISR; aunque, ésta última disminuye (aumenta) las contribuciones de los hogares de menores (mayores) ingresos. El establecimiento de una tasa uniforme del IVA también resulta en una VE global positiva, considerablemente mayor que la que se obtiene con una tasa uniforme para el ISR. Y más aún, la brecha distributiva se incrementa en el último caso, puesto que los hogares más ricos reciben los más altos beneficios.

***Palabras clave*:** alivio a la pobreza, reformas impositivas, matriz de contabilidad social, equilibrio general aplicado, variación equivalente.
***Clasificación JEL*:** D58, I32, I38.

Introduction[3]

Prudent calculations indicate that *per capita* daily expenditure of about 18 million Mexicans, out of a population of 92.6 million, was less than 10 current pesos in 1996, a figure very close to the conventional extreme poverty line set in 1 US$ per day.

Later, the Technical Committee for Mexico's Poverty Measurement (CTMPM, 2005) defined three poverty lines. In 2000, these lines were set at 626 current pesos per month for the Food poverty line, 769.98 for the Capacities poverty line, and 1,258.89 for the Patrimonial poverty line, which roughly amounts to 2.25, 2.76, and 4.52 U.S. dollars per day, respectively. According to this technical committee (dependent of the Ministry of Social Development) in 2000, 24.2% of the Mexican population was below the Food poverty line (23.67 million people).

More recently,[4] the National Council for the Evaluation of the Social Development Policy (Coneval), based on the National Survey of Households' Income-Expenditure (ENIGH-2005) stated that in 2005, 19 million Mexicans did not get the necessary income to access the basic food

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[3] The authors acknowledge the observations made by two anonymous referees, to improve this paper. All errors remain our sole responsibility.
[4] In the newspaper: La Jornada, October 2nd, 2006.

basket. This means that 18.3% of total population was below the Food poverty line.

In order to palliate this pressing problem, the Federal Government started in October 1997 a pilot program, named PROGRESA, to eradicate extreme poverty in Mexico.[5] PROGRESA covered just over 400,000 poor rural families during its first year, but the number went up to 2.3 million in September 1999. During President Fox' Administration, the program, renamed OPORTUNIDADES, kept growing. In 2003, 4.24 million families living in 2,351 municipalities were beneficiaries. In August 2004, president Fox chaired a ceremony to welcome five million beneficiaries, a number close to the amount of families below the extreme poverty line.[6]

A peculiar feature of the program is that cash transfers to participants are conditioned to children's enrollment and assistance to primary and secondary school, as well as family (mainly mothers and children) participation in health control programs and nutrition and hygiene information sessions. The success of the program is pointed out by the fact that four out of every five households in poor alimentary conditions and three out of every four households poorly endowed received benefits in 2002. However, due to several reasons, no significant abatement of poverty has been observed, but this issue goes far beyond the scope of the present paper.

The main goal of this paper is to analyze the consequences of two alternative ways of raising funds to finance poverty alleviation programs in Mexico: a value added tax (VAT) reform and a personal income tax reform (IT). The impact of the reforms is analyzed with an applied general equilibrium model (AGEM) of the Mexican economy, calibrated using a 1996 social accounting matrix. Cash transfers required to attain a fixed increase in the equivalent variation (EV) of the lowest income households are obtained, either increasing effective VAT rates or IT rates. After that, we use the AGEM to obtain changes in welfare and other relevant variables, through simulations of the two mentioned reforms.

In our opinion, the analysis of how to finance poverty fighting is highly relevant, especially in Mexico, where extreme poverty has been, during decades, a hurtful reality for about 20% of Mexicans, and an already chronic stigma for the Mexican economy. This implies that, in order to solve the problem, Mexico cannot rely on external sources, but a sustainable policy must be designed to generate the necessary funds.

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[5] PROGRESA is the acronym of Programa Nacional de Educación, Salud y Alimentación, the Spanish name of the program.

[6] See, SEDESOL, 2003 and 2004.

The development of an algorithm to approximate a fixed point by Scarf [1973 and 1984], and its use by Shoven and Whalley [1972] to study the effects of taxes, marked the beginning of a rapid expansion of the AGE approach, to quantify impacts of fiscal reforms and trade policy on resources allocation and on welfare (Shoven and Whalley [1984]); and also, of higher interest for developing countries, to analyze policy effects on growth and income distribution, (Dervis, De Melo, and Robinson [1982]).

In Mexico, the first application of the AGE approach goes back to the work by Sidaoui and Sines [1979], focused on the analysis of the effects of distortions in factor markets. In the same year, Serra-Puche [1979] presented its Ph.D. dissertation with an AGE model to analyze fiscal reform, which was the basis of the MEGAMEX -a model sponsored by the Bank of Mexico- and of several papers: Kehoe and Serra-Puche [1983a, 1983b][7], Kehoe, Serra-Puche and Solís [1984], and Serra-Puche [1984]. The survey by Decaluwé and Martens [1988] includes, besides the papers by Kehoe and Serra-Puche, a model by Levy [1987] which introduces quantitative restrictions in trade, and the model by Gibson, Lustig, and Taylor [1985] with a Marxist approach.

Some other works analyze specific aspects of the tax system: Ayala [1985], Estrada [1987], Robles [1987], Ibarra [1988], and Apolonio [1992]. Trade policy: Hierro [1983], Sobarzo [1998, 1991], Guerrero, [1989], Pérez [1989], and Francois and Shiells [1994]. The rural sector: Adelman, Taylor, and Vogel [1988], Robinson, Burfisher, Hinojosa-Ojeda and Thierfelder [1991], and Taylor, Yúnez-Naude, and Hampton [1999].

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[7] The model by Kehoe and Serra-Puche (1983a) comprises 14 produced goods, 3 aggregated goods (public, exports, and investment), 15 final consumption goods, and 3 production factors: capital and urban and rural labor. Agents in the model are 5 rural and five urban representative Households, the Government, and the RoW. Production is constant returns to scale nested in three levels. Each Household owns endowments of capital and labor. Households' welfare derives from a Cobb-Douglas utility function on goods and savings (capital tomorrow); savings can be devoted to investment or public debt. Government revenues come from capital's share, and from production, imports, income, and value added taxes. Government's deficit is financed through public debt. RoW's revenue comes from imports, and it is used to buy exports, the difference between revenue and expenditures is the RoW's savings. In this model labor markets could not clear because of assumed frictions, generating unemployment. The model was calibrated to replicate the economy in 1977, and was mainly used to analyze the impact from introducing the VAT with several scenarios: Constant (variable) real urban wages, variable (constant) unemployment, and constant (variable) public deficit. The VAT rate used was 10%, except for agricultural products, food, educative materials, and professional services with 0%. Although they had interesting results, the authors conclude that the distributive policy impact crucially depends on the macroclosure, particularly, on whether the public deficit is kept constant or not.

There are studies that analyze cash transfer programs. Coady [2001], and Maldés, Coady and Maluccio [2004], have studied the cost effectiveness of cash transfer targeted programs in Mexico and other Latin America countries using a cost-benefit approach. Coady and Harris [2000], analyzed the welfare impact of cash transfer programs in Mexico using an applied general equilibrium model (AGEM) calibrated to a 1996 SAM. In this framework, Coady and Harris study the welfare consequences of two alternative ways to finance a 30% increase in poor rural households' nominal income. This amounts to a 2% of GDP. In the first place, all subsidies on manufactured maize, wheat and dairy products are eliminated and income lump sum taxes are adjusted to hold constant the Government deficit. Second, cash transfers to the poorest are financed using several schemes to raise value added tax (VAT) revenues keeping also constant the Government deficit. Actually, the second scenario was seriously considered by President Fox's Administration that publicized in 2003 an initiative –never implemented- to set a uniform 10% VAT rate

In line with these studies and government proposals, our paper provides estimates of the welfare effects of tax financed transfers programs using an AGEM of the Mexican economy. This AGEM is quite different from that of Coady and Harris (2000). It is a national model with 18 production sectors, 10 representative consumers, Government and the RoW. Moreover, the model is calibrated using a completely different, and disaggregated, social accounting matrix, the SAM-MX96, constructed for the base year 1996 (Núñez, G. [2004]).

This paper compares two VAT schemes to finance poverty alleviation programs, similar to those studied by Coady and Harris [2000], and two personal income tax (IRS) reforms, an alternative disregarded in their work. To evaluate the allocation and welfare impact of these reforms, percentage changes in activity and utility levels are calculated, as well as Hicks' equivalent variation (EV).

The approach followed to evaluate the policy reforms is also different from the approach used by Coady and Harris [2000]. The policy scenarios are chosen in order to generate a Government surplus that, once transferred to the poorest household decile, increases the EV of the poorest family in a fixed amount. The fiscal reforms considered are: rescaling all VAT rates or ISR rates, and setting a uniform VAT or a uniform ISR rate.

The paper is organized as follows. Section I presents the main features of the SAM-MX96 and section II those of the AGE model. Section III presents simulations and results. Finally, section IV concludes with some final remarks.

I. The SAM-MX96

Table 1.1 shows the main blocks of the SAM-MX96, which disaggregates the circular income flow for the Mexican economy during 1996. We follow the usual convention by which rows account for “income”, and columns for “expenditures”.

As usual when preparing a SAM, we relied on an Input-Output Table (CIESA, [1996], and on Mexico’s National Accounting System (SCNM)[8], as the main statistical sources. This information has been complemented with the “National Survey of Households’ Income-Expenditure” (INEGI [1999b]) to workout the relationship between production and private consumption. In addition, the following sources were also used: “Federal Income Accounting” (SHCP [2001]); “Compendium of Fiscal Federal Laws” (Fisco Agenda 97 [1997]); “Annual Statistical Information, Exports/Imports, 1993-200” (Bancomext [2000]); and the “Annual Report, 1996” (Banxico [1996]).

The first account of the SAM-MX96, disaggregates total population into 10 representative Households, defined by income decile, this income comes from Transfers, Labor, and Capital. Households pay taxes, save, and buy 10 private consumption goods.

The second institution, Government, levies taxes and Social Security contributions, then, it pays Transfers to Households, Collective Services, Public Health and Education, transfers to RoW, and saves what is left. Income Taxes come from Households and from the corporate sector (Capital). Indirect Taxes minus Subsidies, Other Taxes to Production, and Social Security contributions, are levied on Activities. The Value Added Tax is charged on Private Consumption goods. Social Transfers are paid by the Government as we said, and Other Transfers come from the Government and from the Rest of the World also.

The Savings account collects savings from Households, Government, Capital, and RoW, and then the Investment account buys investment goods from the Activities.

Labor has been disaggregated into 18 types, according to the classification provided by the ENIGH-96, based on the notion that the post occupied by a worker better reflects his qualification than his scholar degree. Labor obtains income from Activities and distributes it among the

[8] SCNM’s information comes in three volumen: “Cuentas de Bienes y servicios 1988-00” (Goods and Services Accounting); “Cuentas por Sectores Institucionales, 1993-98” (Institutional Sectors Accounting); “Indicadores Macroeconómicos del Sector Público, 1988-99” (Public Sector Macroeconomic Indicators).

households. We assume capital moves freely from any sector in the economy to any other sector, therefore we have only one homogeneous Capital, which distributes its income among Households, Taxes, Savings, and the RoW.

As for the Activities, we define eighteen: seventeen from the National Accounts System, and another one to account for Government expenditures on public goods. Activities hire Labor and Capital, buy domestic and imported inputs, and pay Taxes including Social Security contributions, to produce the Total Supply. Total Supply is then sold to Investment, Intermediate Consumption, Private Consumption Goods, Public Goods, and Exports.

Labor and capital income (plus non-resident income) is distributed between institutions according to their property rights.

The Private Consumption Goods account is a transformation account which "buys" homogeneous goods and services from the Activities to combine them in order to "produce" 10 Private Consumption Goods. The VAT is charged to consumers and then it is transferred to the Government.

Finally, the RoW gets income from Imports and Transfers (corporate sector and Government), and pays for Transfers to Households, Savings (Current Account Deficit), Labor (Remittances), and Exports. Appendix 1 defines every entry of the matrix and Appendix 2 contains the SAM-MX96.

Table 1.1 **Main Blocks of the SAM-MX96 (pesos of 1996)**

	H	G	IT	IT-S	OTP	VAT	SS	ST	OT	INVESTMENT
Households (10)								29,427,283	42,392,016	
Government			118,028,898	136,202,471	9,689,701	90,095,116	66,688,160			
Income Taxes	50,592,091									
Indirect Taxes – Subsidies										
Other Taxes to Production										
Value Added Tax										
Social Security										
Social Transfers		29,427,283								
Other Transfers		7,968,896								
Savings	192,880,673	103,212,438								
Labor (18)										
Capital										
Activities (18)										583,558,024
Private Consumption Goods (10)	1,642,422,657									
Colective Services		110,761,607								
Public Health		41,867,183								
Public Education		91,077,046								
RoW		36,389,893								
TOTAL	**1,885,895,421**	**420,704,346**	**118,028,898**	**136,202,471**	**9,689,701**	**90,095,116**	**66,688,160**	**29,427,283**	**42,392,016**	**583,558,024**

	L	K	A	PCG	CS	PH	PE	RoW	TOTAL
Households (10)	667,809,664	1,146,266,458							**1,885,895,421**
Government									**420,704,346**
Income Taxes		67,436,807							**118,028,898**
Indirect Taxes – Subsidies			136,202,471						**226,297,587**
Other Taxes to Production			9,689,701						**9,689,701**
Value Added Tax				90,095,116					**90,095,116**
Social Security			66,688,160						**66,688,160**
Social Transfers									**29,427,283**
Other transfers								34,423,120	**42,392,016**
Savings		270,908,775						16,556,138	**583,558,024**
Labor (18)			662,301,178					5,508,486	**667,809,664**
Capital			1,558,112,676						**1,558,112,676**
Activities (18)			1,855,760,199	1,552,327,541	110,761,607	41,867,183	91,077,046	559,387,191	**4,794,833,907**
Private Consumption Goods (10)									**1,642,422,657**
Colective Services									**110,761,607**
Public Health									**41,867,183**
Public Education									**91,077,046**
RoW		73,500,636	505,984,406						**615,874,935**
TOTAL	**667,809,664**	**1,558,112,676**	**4,794,833,907**	**1,642,422,657**	**110,761,607**	**41,867,183**	**91,077,046**	**615,874,935**	

II. The AGE model of the Mexican economy

The AGE model used in this study is a standard static model.[9] A short summary of the model features follows.

Agents

The model includes 18 productive Activities, 10 Households (classified by income), and the Government. External sectors are aggregated into one RoW. Corporations, although distinguished from Households for accounting reasons, play no active role in the model.

Goods and factors

There are 18 produced commodities that are used in production, satisfying private and public consumption and export demand. Produced commodities are combined in fixed proportions to obtain private consumption and investment goods. There are also 17 types of labor and a homogeneous capital good. The investment is a fixed proportions bundle of produced commodities.

Producers

Production is a constant returns to scale nested technology. At the highest level, aggregate commodities are a CES Armington mix of domestic goods and imports. Domestic goods are produced in fixed proportions using Value Added and intermediate consumption. Finally, Valued Added is a Cobb-Douglas aggregate of 17 types of labor and capital.

Producers maximize profits subject to the technology constraint and determine factor demands and prices in the usual way. a) At the lowest level of the nest: primary factors demands and the price of value added are

[9] The model´s equations are in Appendix 3.

obtained. b) At the intermediate level: value added and intermediate commodity demands and domestic prices are computed. And C) at the highest level: domestic commodities and imports demands and aggregate commodity prices are calculated.

Three tax rates influence those decisions. A social security tax is levied on labor services hired by producers and an *ad valorem* tax burdens producers' purchases of domestic commodities and equivalent imports.

Households

Households' welfare is a two level nested function. Utility is a CES function of present and future consumption and present consumption is, in turn, a Cobb-Douglas aggregate of 10 private consumption commodities. As indicated above, private consumption goods are produced with aggregate commodities, and are subject to a sales tax calculated from the value added tax revenues.

Households maximize utility subject to a complex budget constraint. At the top level, present and future consumption expenditures must not exceed net of taxes disposable income. Consumers' gross income is derived from sales of labor and dividends paid out by corporations. Gross income is then adjusted by net Government transfers and personal income taxes to obtain net disposable consumers' income.

Firms

Although firms are owned by households, they are treated separately. Their gross income is the value of capital services sold to producers and their net disposable income is calculated taking out profit taxes and dividends paid out to households. Their net disposable income can be used to retain net earnings or to finance investment.

Government

Government is a producer, a consumer, and plays and active role in the process of income distribution. As any producer, the Government uses factors (aggregate commodities, labor and capital) to produce one public commodity (general services) and two services provided to households (health and education). The way the latter two are allocated among the 10 households is not known and their impact on households' utility is disregarded. Ignoring this issue does not affect the results, since Government policy supply is unchanged in the simulations. Additional transfers to households are paid with additional revenues.

As mentioned, Government current revenues come from social security, production, imports, value added and personal and corporation income taxes. Government current expenditures include the costs incurred to produce three publicly supplied services (collective, health, and education), social transfers[10], other current transfers[11], and transfers to the rest of the world (debt service). The government also saves and invests (in public infrastructures), so, the difference between total current revenues and total expenditures define government's deficit.

Rest of the World

The Rest of the World (RoW) demands capital, labor, and goods and services. Following Armington (1969), imports are imperfect substitutes of domestic commodities and producers choose the optimal mix to maximize profits. Exports are exogenously fixed and, therefore, the external deficit is endogenous. A positive difference between all revenues (value of imports plus labor and capital payments and transfers to other countries) and expenditures (value of exports plus labor and capital revenues and transfers from other countries) determine the external savings used to finance domestic investment.

Market clearing

Commodity markets always clear. For each commodity, the sum of intermediate consumption by producers, commodity demand used to produce private and public consumption commodities, investment demand and exports equal total supply provided by domestic producers and the external sectors (imports). Capital services demanded by producers also equal total households' endowments. Labor markets may or may not clear. In the latter case, the real wage is assumed to be a function of the unemployment rate, so that:

$$\frac{w}{CPI} = k_0 \left(1-u\right)^{\frac{1}{\beta}}$$

where w is the wage rate, CPI a consumer's price index, u the unemployment rate, k_0 a calibration constant, and the elasticity β an exogenous parameter. (See Kehoe and Serra-Puche [1983a], and Polo and Sancho [1993]).

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[10] Known as "Prestaciones", these transfers may vary from employer to employer, usually they refer to the following: 1) One month of extra salary every December (Aguinaldo), 2) Holidays specified by the Federal Labor Law, 3) Employer contributions for a federal fund to support loans to buy or build a house (Infonavit), and 4) Profits sharing.

[11] Generally, direct transfers to the poor through food coupons.

Macroeconomic closures

Investment is a composite good produced in fixed proportions determined by the commodity composition of investment in the base year. The value of investment equals the value of private savings plus public savings, plus (minus) the current account.

Because our model is static, when we simulate a reform to evaluate its effects on welfare, allowing investment variations, we could observe, at the same time, an increase in welfare and a decrease in investment, not knowing how much of the increase in welfare comes from the reform itself, and how much from investment's decrease. Therefore, to isolate the reform's effect, we carry out simulations keeping constant the level of investment at the initial level, by compensating variations in private savings with variations -in the opposite direction- in public savings. Under the same argument, we fix the external deficit at the initial level, allowing exports' variations to compensate for any variation in imports. (See Lofgren, Harris, and Robinson [2002], pp. 14-17).

Equilibrium

In the clearing version of the model, an equilibrium is a price vector, production and consumption plans, a government surplus and a surplus for the external sector, such that those plans maximize consumers utility subject to their budget constraint, maximize producers profits, the government surplus equals the difference between government revenues and expenditures, the external sector surplus equal the difference between revenues and expenditures and all markets clear. In the non-clearing version, a vector of unemployment rates is endogenously determined and households' income depends on the unemployment rate.

Welfare variations

Welfare changes generated by reforms are evaluated with Hicks' Equivalent Variation (EV), defined as the income transfer required by a household to achieve the new utility level at the initial prices, that is, the amount of money necessary for the household to arrive to the utility level that the reform would generate.

III. Fiscal scenarios and results

According to the SAM-MX96, and as the second column of Table 3.5 shows, 34.7% of Government's total current revenue comes from Production taxes, the VAT contributes with 21.4%, Social Security contributions with 15.9%, Corporation taxes with 16%, and (Personal) Income taxes with 12%. As for the expenditures, 7% of government's current revenues is devoted to Social Transfers, 1.9% to Other Transfers, 24.5% to investment, 26.3% to Collective Services (which include bureaucracy payroll and Government expenses), 10% to public health, 21.6% to public education, and 8.7% to the rest of the world (debt service).

Table 3.1 presents 1996 VAT rates (column VAT0) on the 10 private consumption commodities and ISR rates (column ISR0) on the 10 households included in the model. The VAT0 rates are effective tax rates estimated using the VAT revenue figures in the SAM-MX96 and the technology used to produce consumption goods. The results lead to classify commodities in three groups.

Table 3.1 **1996 benchmark and simulated tax rates**

	VAT rates on commodities (%)				**ISR rates on households (%)**		
	VAT0	**S1** **VAT0 × 1.187**	**S3** **Uniform VAT**		**ISR0**	**S2** **ISR0 × 1.447**	**S4** **Uniform ISR**
C1	0.67	0.79	7.06	**H1**	0.20	0.29	3.79
C2	10.18	12.08	7.06	**H2**	0.65	0.94	3.79
C3	5.66	6.71	7.06	**H3**	1.05	1.52	3.79
C4	10.18	12.08	7.06	**H4**	1.20	1.74	3.79
C5	0.00	0.00	7.06	**H5**	1.31	1.89	3.79
C6	5.52	6.55	7.06	**H6**	1.33	1.92	3.79
C7	6.76	8.02	7.06	**H7**	1.36	1.96	3.79
C8	2.79	3.31	7.06	**H8**	1.69	2.44	3.79
C9	10.18	12.08	7.06	**H9**	2.01	2.91	3.79
C10	9.50	11.27	7.06	**H10**	4.76	6.89	3.79

Notes: 1. VAT0 and ISR0 are the benchmark vectors of VAT and ISR rates, respectively. 2. 1.187 is the scaling factor applied to benchmark VAT rates and 1.447 the scaling factor applied to benchmark ISR rates.

The more heavily taxed includes Clothes and Shoes (C2), Furniture, and domestic equipment and gadgets supplies (C4), Hotels, coffee shops and restaurants (C9), and Other goods and services (C10) with VAT rates in the neighborhood of 10%. The intermediate group includes Entertainment and culture (C7), Housing, electricity, gas, water (C3) and Transportation (C6) with VAT rates near 6%. The last subset includes low taxed commodities such as Education (C8) and Food and beverages and tobacco (C1) and Health (C5) with a zero rate.

Low (high) income families are more likely to spent their income in commodities with low (high) VAT rates. Therefore, one can expect that setting a unique VAT rate will especially hit (favor) those households having large expenditure shares in the relatively low (high) tax commodities. Table 3.2 shows the commodity shares of the 10 consumption goods in households' present consumption.

Effective ISR rates in the benchmark are pretty low. Notice that effective rates for all households, except for the richest decile, are below 2% and that, the rate structure, although progressive, is pretty flat in the middle income deciles (H3-H7). It is likely -as in VAT case- that setting a uniform ISR rate will hit (favor) low (high) income households.

Table 3.1 also shows the endogenously determined tax structure in each of the four policy scenarios simulated.[12] In all cases tax rates are set to achieve a 20 unit increase in Hicks' EV of the poorest household by transferring to it the extra government revenue obtained from the reform.[13] In column S1 (S4) it appears the new VAT (ISR) rates are scaled up by 1.187 (1.447), while in column S2 (S4) all VAT (ISR) rates are set equal to 7.06% (3.79%). Just as a reference, flat levels for the VAT and ISR that maintain the benchmark public surplus are 5.94% and 2.57% respectively.

With respect to changes in total supply, as expected since simulated reforms are relatively small, and as table 3.3 shows, no changes greater than 3% are observed. Also, given that VAT rates for the agricultural and food sectors are initially equal to zero, when we simulate a uniform tax, which implies a 7.06% increase for said sectors, we would expect that the greatest diminutions in total supply would occur there, as it actually happens.

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[12] The simulations reported assume all labor markets clear. These results are not significantly altered when the real wage is assumed to depend on the unemployment rate and the latter is endogenously determined. Rescaling VAT rates is once more the most appropriate policy in terms of global EV although the unemployment rate increases slightly.

[13] The 20 unit increase has been chosen because it takes the poorest households' utility level roughly just under that of the second decile's, which are just under the extreme poverty line.

Table 3.2. **Percentage Consumption Goods shares in Households' Present Consumption**

Commodity	VAT0	H1	H2	H3	H4	H5	H6	H7	H8	H9	H10
C1	0.67	40.4	34.4	33.4	30.9	29.2	25.7	24.2	21.7	17.5	11.3
C2	10.18	1.6	1.5	1.6	1.5	1.7	1.6	1.6	1.7	1.8	1.6
C3	5.66	18.6	19.8	19.1	18.9	18.7	17.6	16.8	17.8	14.5	14.8
C4	10.18	6.3	5.6	5.5	4.9	4.9	4.5	4.4	4.6	4.5	5.2
C5	0.00	3.5	3.6	4.6	4.3	3.2	2.4	2.7	3.0	3.4	3.2
C6	5.52	8.6	8.4	9.4	9.9	10.8	12.1	11.8	12.3	12.3	15.7
C7	6.76	0.9	1.1	1.1	1.2	1.5	1.8	1.7	2.3	3.4	4.8
C8	2.79	3.3	3.8	4.5	4.7	5.0	5.1	6.0	6.0	6.7	8.1
C9	10.18	9.8	14.8	14.1	16.3	16.1	21.6	23.2	21.8	26.8	25.1
C10	9.50	6.9	7.1	6.8	7.2	8.9	7.7	7.8	8.7	9.3	10.2
Total		**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**

The first four columns of table 3.4 present Hicks' EV for the 10 income deciles. In all scenarios, the policy reform achieves the same increase for poorest income decile and all the other households register a welfare lost with just one exception: the richest decile increases its welfare when the additional revenues used to finance the transfer are obtained setting a uniform income rate (3.79%) lower than the tax rate paid by the richest decile (4.79%) in 1996. The overall increase in welfare obtained by adding up the impact on all households' deciles is reported in the last row (Total) of the table. It is positive for the two VAT reforms (S1 and S3), negative when ISR rates are scaled up (S2) and slightly positive when a single income rate is set (S4).

Table 3.3 Total supply: Benchmark values and percentage variation

Activities	Benchmark	S1 IVA0 × 1.187	S2 ISR0 × 1.447	S3 7.06% VAT	S4 3.79% ISR
A1	245.594	1.487	0.994	-2.622	0.465
A2	80.925	0.080	0.079	-0.166	0.058
AI	423.766	1.656	1.101	-2.917	0.512
AII	131.502	-0.187	0.002	1.010	0.009
AIII	39.538	-0.030	0.081	0.647	0.094
AIV	74.613	-0.058	-0.121	-0.340	-0.024
AV	305.131	0.018	0.018	0.000	0.051
AVI	72.658	0.006	0.118	0.702	0.114
AVII	120.819	0.040	0.039	-0.180	0.036
AVIII	815.858	0.004	0.004	-0.153	0.030
AIX	78.556	0.010	-0.013	-0.209	0.013
A4	224.752	0.000	0.001	0.000	0.000
A5	47.549	0.067	0.086	0.053	0.029
A6	659.246	-0.630	-0.335	1.520	-0.229
A7	373.467	-0.266	-0.243	0.189	-0.057
A8	434.424	0.042	0.086	0.213	0.002
A9	555.579	-0.114	-0.208	-0.405	-0.044
A10	110.762	0.000	0.000	0.000	0.000

Table 3.4 Benchmark utility and households' EV

		Equivalent Variation				Percentage change with respect to initial utility			
House-Hold	Bench-mark Utility	S1 IVA0 × 1.187	S2 ISR0 × 1.447	S3 7.06% VAT	S4 3.79% ISR	S1 IVA0 × 1.187	S2 ISR0 × 1.447	S3 7.06% VAT	S4 3.79% ISR
H1	30.719	20.000	20.000	20.000	20.000	65.11	65.11	65.11	65.11
H2	56.167	-0.401	-0,157	-1.101	-1.768	-0.72	-0.28	-1.96	-3.15
H3	71.212	-0.516	-0.330	-1.461	-1.966	-0.72	-0.46	-2.05	-2.76
H4	91.961	-0.715	-0.494	-1.692	-2.405	-0.78	-0.54	-1.84	-2.61
H5	109.484	-0.903	-0.652	-1.787	-2.752	-0.82	-0.60	-1.63	-2.51
H6	138.870	-1.224	-0.838	-1.777	-3.457	-0.88	-0.60	-1.28	-2.49
H7	174.595	-1.501	-1.084	-1.944	-4.301	-0.86	-0.62	-1.11	-2.46
H8	208.020	-1.893	-1.634	-2.208	-4.456	-0.91	-0.79	-1.06	-2.14
H9	295.494	-2.845	-2.783	-2.058	-5.365	-0.96	-0.94	-0.70	-1.82
H10	658.781	-5.894	-14.834	-2.717	6.705	-0.89	-2.25	-0.41	1.02
Total		**4.108**	**-2.806**	**3.255**	**0.235**				

The percentage utility changes for the 10 households' deciles appear in the last four columns. Scaling up all VAT rates (S1) reduces the utility of all other deciles by almost the same percentage (0.7-1.0 per cent), while the impact of scaling up the ISR rates increases with income and reaches 2.25% for the richest decile. The impact of setting a uniform VAT or ISR rates (scenarios S3 and S4, respectively) are clearly regressive, especially the latter one that reduces the second poorest income decile by 3.2% and increases the utility of the richest decile by almost 1%.

Comparison of S3 (uniform VAT) and S4 (uniform ISR) shows that both, VAT and ISR's are progressive, but ISR is more progressive, given that the highest income decile is highly benefited, in both cases medium-high income deciles bear the greatest part of the reform's cost. Considering the four reforms analyzed, and from a global efficiency viewpoint, results suggest that the best policy, among the alternatives considered, would be an increase in IVA maintaining its structure, because this would give the greater global benefit in terms of the EV.

Table 3.5 shows the effects of each reform on fiscal revenues. Production tax revenues and Social security contributions changes are modest, always under 1% of their benchmark values. Therefore, the change in Government revenues that appears in the last row is determined by the change in VAT revenues (S1 y S3) or ISR revenues (S2 and S4). The results indicate that the surplus transferred to the poorest household when VAT rates are scaled up by 1.187 (column S1) 16.495 is less than 18.355, the amount transferred when a single 7.06% VAT rate is set.

This is so because a uniform VAT rate increases the price of commodities bought by the poorest household and the amount transferred has to be larger. If the extra revenue is obtained scaling up ISR tax rates (column S2), the budget surplus required to achieve the same welfare increase of the poorest household, 22.459, is much larger than in the two previous scenarios and greater than 20.793 the transfer required when there is a flat income tax rate (Column S4, 20.793).

Table 3.5 Government tax revenues

	Million pesos					Percentage change			
	1996	**S1** IVA0 × 1.187	**S2** ISR0 × 1.447	**S3** 7.06% VAT	**S4** 3.79% ISR	**S1** IVA0 × 1.187	**S2** ISR0 × 1.447	**S3** 7.06% VAT	**S4** 3.79% ISR
Production	145.892	146.423	146.240	144.828	146.084	0.364	0.239	-0.729	0.132
VAT	90.095	106.156	89.736	109.504	89.923	17.827	-0.398	21.543	-0.191
Social security	66.688	66.602	66.597	66.680	66.662	-0.129	-0.136	-0.012	-0.039
Corporation	67.437	67.437	67.437	67.437	67.437	0.000	0.000	0.000	0.000
Income Tax	50.592	50.581	73.154	50.610	71.393	-0.022	44.596	0.036	41.115
TOTAL	420.704	437.199	443.163	439.059	441.497	3.921	5.338	4.363	4.942
Δ TOTAL		16.495	22.459	18.355	20.793				

Notes: see Table 3.1.

Finally, a note on drawbacks and shortcomings of our model is in place. All the caveats for AGE models apply to our model. The well known advice about taking this kind of results with caution should be kept in mind when drawing possible policy implications, since such results constitute a guidemore than an exact quantitative analysis- to what could possibly happen if a reform is implemented.

On the other hand, our model has been designed on the base of a 1996 SAM. First, the fact that this type of AGE analysis is based on a single point observation constitutes one of the most frequent criticisms against it. Since it is not our purpose to tackle methodological issues here, we argue that 1996 is a typical year in the Mexican economy so that, our results are valid to the extent that said type of static AGE analysis is valid. Second, 1996 is an eleven years old year, and results might, or might not, apply to actual circumstances, depending on how much the structure of the economy has changed. No doubt, actualization of data bases[14] is necessary to further study these issues, and to confirm or correct several results.

Another frequent criticism goes about the use of exogenous (non-SAM calibrated) parameters, such as the substitution elasticity, since results might be very sensitive to elasticity specification. In our case, we use Armington elasticities to account for the degree of substitution between imports and domestic goods, and similar elasticities to account for the degree of substitution between present and future consumption. To asses if these elasticities are driving the results in certain direction, sensitivity analysis are performed. According to the series of simulations we performed using alternative sets of elasticities, the qualitative results are robust, and quantitative results do not experiment significant changes.

VI. Final comments

An AGE model is used to analyze the efficiency degree of four alternative reforms that generate funds devoted to alleviate extreme poverty. The results suggest that, from a global Equivalent Variation (EV) viewpoint, (comparable in the sense that each reform generates the same EV for the lowest income decile), financing the policy of direct transfers through an increase in the VAT (keeping its structure) is more efficient than financing through an increase in ISR (keeping its structure).

Our results about the efficiency of direct transfers are underestimated because our model does not take into account potential gains, such as the

[14] In the first quarter of 2008, INEGI published an Input-Output Table (IOT) of the Mexican economy for the year 2003. The previous IOT available from INEGI was one for the year 1985, which resulted from a series of actualizations of a 1978 IOT. As far as we know, there are no clues on whether the INEGI will set a periodicity for this work, or we are going to wait again about 30 years –or any random amount of years-, to see another survey-based IOT for Mexico.

increase in human capital derived from, for example, conditioned direct transfers to school and public health institutions attendance, like PROGRESA/OPORTUNIDADES.

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Appendix 1. SAM-MX96 accounts

H1	1	First decile of households
H2	2	Second decile of households
H3	3	Third decile of households
H4	4	Fourth decile of households
H5	5	Fifth decile of households
H6	6	Sixth decile of households
H7	7	Seventh decile of households
H8	8	Eight decile of households
H9	9	Ninth decile of households
H10	10	Tenth decile of households
L1	11	PROFFESIONALS
L2	12	TECHNICIANS
L3	13	EDUCACION WORKERS
L4	14	ART, SHOWS, AND SPORTS WORKERS
L5	15	FUNCTIONARIES AND MANAGERS OF THE PUBLIC, PRIVATE, AND SOCIAL SECTORS
L6	16	WORKERS IN AGRICULTURAL, LIVESTOCK, FORESTRY, AND HUNTING AND FISHING ACTIVITIES
L7	17	SUPERVISORS AND OTHER CONTROL WORKERS
L8	18	ARTISANS AND WORKERS IN THE TRANSFORMATION INDUSTRY
L9	19	MACHINE OPERATORS IN INDUSTRIAL PRODUCTION
L10	20	ASSISTANTS, PEONS AND SIMILARS IN THE TRANSFORMATION INDUSTRY
L11	21	DRIVERS AND ASSISTANTS
L12	22	COORDINATORS AND SUPERVISORS IN ADMINISTRATIVE AND SERVICES ACTIVITIES
L13	23	ASSISTANTS IN ADMINISTRATIVE ACTIVITIES
L14	24	MERCHANTS, COMMERCE EMPLOYEES AND SALES AGENTS
L15	25	WALKING MERCHANTS AND WALKING WORKERS
L16	26	EMPLOYEES IN ESTABLISHMENTS FOR PERSONAL SERVICES
L17	27	WORKERS IN DOMESTIC SERVICES
L18	28	WORKERS IN PROTECTION SERVICES AND THE ARMY
K	29	Capital
A1	30	Agriculture, livestock, forestry, hunting and fishing
A2	31	Mining
AI	32	Food, beverages and tobacco
AII	33	Textiles, clothes, and leather industries
AIII	34	Wood Industry and Wood products
AIV	35	Paper, paper products, printing-houses and publishers
AV	36	Chemicals, oil derivatives, rubber and plastic
AVI	37	Non metallic mining products
AVII	38	Basic metallic industries
AVIII	39	Metallic products, machinery and equipment
AIX	40	Other manufacturing
A4	41	Construction
A5	42	Electricity
A6	43	Commerce, restaurants and hotels
A7	44	Transportation, storage and communications
A8	45	Financing services, insurance and real estate
A9	46	Communal, social, and personal services
A10	47	Collective services
C1	48	Food, beverages and tobacco
C2	49	Clothes and shoes
C3	50	Housing, electricity, gas, and water
C4	51	Furniture, and domestic equipment and gadgets
C5	52	Health
C6	53	Transportation
C7	54	Entertainment and culture
C8	55	Education
C9	56	Hotels, coffee shops, and restaurants
C10	57	Diverse goods and services
AAPP	58	Government
IIRE	59	Income tax
IIMS	60	Indirect taxes minus subsidies
IP	61	Other taxes to production
IVA	62	Value added tax
CS	63	Social Contributions
PS	64	Social transfers
OT	65	Other transfers
AHBR	66	Savings-Investment
CSC	67	Collective services consumption
CSP	68	Public health consumption
CEP	69	Public education consumption
PGRDM	70	PAYMENTS TO THE REST OF THE WORLD
TLCAN	71	EXTERNAL SECTOR NAFTA AREA
RDP	72	EXTERNAL SECTOR REST OF COUNTRIES

Appendix 2. The Social Accounting Matrix of Mexico for 1996 (SAM-MX96)

MCS-MX96	H1	H2	H3	H4	H5	H6	H7	H8	H9	H10
H1										
H2										
H3										
H4										
H5										
H6										
H7										
H8										
H9										
H10										
SOC										
AAPP										
IIRE	62,301	369,442	755,722	1,116,543	1,448,972	1,870,024	2,403,559	3,566,393	6,070,281	32,928,853
IIMS										
IP										
IVA										
CS										
PS										
OT										
AHBR	767,482	1,564,081	1,694,621	2,707,137	3,640,015	6,055,036	16,213,246	13,399,683	23,574,576	123,264,795
L1										
L2										
L3										
L4										
L5										
L6										
L7										
L8										
L9										
L10										
L11										
L12										
L13										
L14										
L15										
L16										
L17										
L18										
K										
A1										
A2										
AI										
AII										
AIII										
AIV										
AV										
AVI										
AVII										
AVIII										
AIX										
A4										
A5										
A6										
A7										
A8										
A9										
A10										
C1	12,107,260	18,780,689	23,188,034	27,616,083	30,897,017	34,124,197	38,331,414	42,321,591	47,556,544	60,733,519
C2	480,164	826,012	1,082,715	1,328,353	1,817,497	2,080,319	2,524,416	3,370,990	4,863,824	8,510,742
C3	5,579,497	10,787,797	13,269,005	16,910,772	19,748,615	23,412,552	26,618,604	34,609,192	39,439,125	79,092,344
C4	1,898,874	3,080,109	3,842,437	4,382,639	5,145,300	5,945,433	6,916,008	8,984,679	12,325,038	27,958,078
C5	1,039,796	1,973,305	3,225,893	3,866,521	3,402,654	3,180,691	4,213,311	5,886,716	9,160,240	17,109,105
C6	2,579,590	4,563,495	6,501,235	8,864,457	11,418,377	16,080,042	18,624,816	23,879,038	33,323,238	83,842,519
C7	278,639	603,038	738,987	1,053,695	1,561,154	2,330,093	2,691,314	4,550,638	9,112,014	25,970,364
C8	975,976	2,063,555	3,118,925	4,181,724	5,307,774	6,796,443	9,469,648	11,644,024	18,095,199	43,298,289
C9	2,931,145	8,064,730	9,788,541	14,579,357	17,088,797	28,700,200	36,694,921	42,434,374	72,821,577	134,345,659
C10	2,080,897	3,859,987	4,761,726	6,470,356	9,457,061	10,165,105	12,297,211	16,938,722	25,222,714	54,655,567
CSC										
CSP										
CEP										
PGRDM										
TLCAN										
RDP										
TOTAL	**30,781,621**	**56,536,239**	**71,967,842**	**93,077,637**	**110,933,233**	**140,740,134**	**176,998,468**	**211,586,039**	**301,564,371**	**691,709,834**

MCS-MX96	SOC	AAPP	IIRE	IIMS	IP	IVA	CS	PS	OT	AHBR
H1	25,093,060							922,230	1,328,536	
H2	41,687,294							1,831,498	2,638,398	
H3	49,455,561							1,928,965	2,778,806	
H4	62,577,112							1,969,165	2,836,717	
H5	71,151,615							2,162,519	3,115,256	
H6	90,882,071							2,319,600	3,341,543	
H7	114,608,590							2,648,448	3,815,270	
H8	126,014,336							3,618,229	5,212,307	
H9	178,260,188							4,783,988	6,891,663	
H10	386,536,629							7,242,642	10,433,521	
SOC										
AAPP			118,028,898	136,202,471	9,689,701	90,095,116	66,688,160			
IIRE	67,436,807									
IIMS										
IP										
IVA										
CS										
PS		29,427,283								
OT		7,968,896								
AHBR	270,908,775	103,212,438								
L1										
L2										
L3										
L4										
L5										
L6										
L7										
L8										
L9										
L10										
L11										
L12										
L13										
L14										
L15										
L16										
L17										
L18										
K										
A1										2,293,275
A2										63,419
AI										33,635,954
AII										16,109,035
AIII										7,289,219
AIV										3,811,919
AV										15,634,813
AVI										4,134,913
AVII										5,014,511
AVIII										183,313,021
AIX										24,588,220
A4										224,256,523
A5										0
A6										50,623,302
A7										12,293,154
A8										0
A9										496,746
A10										
C1										
C2										
C3										
C4										
C5										
C6										
C7										
C8										
C9										
C10										
CSC		110,761,607								
CSP		41,867,183								
CEP		91,077,046								
PGRDM	73,500,636	36,389,893								
TLCAN										
RDP										
TOTAL	**1,558,112,675**	**420,704,346**	**118,028,898**	**136,202,471**	**9,689,701**	**90,095,116**	**66,688,160**	**29,427,283**	**42,392,016**	**583,558,024**

MCS-MX96	**L1**	**L2**	**L3**	**L4**	**L5**	**L6**	**L7**	**L8**	**L9**	**L10**
H1	13,712	69,685	64,129	19,229	1,493	423,520	1,669	564,964	150,574	414,895
H2	42,453	133,006	66,313	106,652	22,925	1,147,328	29,531	1,794,492	418,700	1,453,323
H3	96,879	415,238	186,766	134,122	80,751	1,624,233	70,079	3,051,720	784,634	2,691,528
H4	42,743	409,596	330,573	127,452	23,447	1,680,487	187,481	4,579,267	1,753,367	3,577,599
H5	158,665	849,008	376,049	162,879	131,942	1,321,073	219,214	6,075,049	2,666,436	4,706,844
H6	232,216	1,904,982	1,292,409	391,272	114,151	1,282,468	964,170	9,197,266	3,638,517	4,834,327
H7	921,080	3,352,944	1,156,645	419,330	322,249	1,395,505	1,747,649	10,251,653	3,370,008	3,253,568
H8	2,554,551	5,759,175	5,914,814	1,104,431	1,628,886	1,080,579	2,290,156	10,963,632	3,008,165	3,071,463
H9	8,158,772	8,858,073	17,301,754	1,841,799	5,025,067	1,316,729	4,591,324	11,055,424	2,182,056	1,859,991
H10	39,416,075	12,569,813	23,253,747	4,437,479	65,587,795	6,416,970	12,685,343	14,096,908	3,113,056	1,379,018
SOC										
AAPP										
IIRE										
IIMS										
IP										
IVA										
CS										
PS										
OT										
AHBR										
L1										
L2										
L3										
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AII										
AIII										
AIV										
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AVI										
AVII										
AVIII										
AIX										
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C1										
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C7										
C8										
C9										
C10										
CSC										
CSP										
CEP										
PGRDM										
TLCAN										
RDP										
TOTAL	**51,637,146**	**34,321,520**	**49,943,200**	**8,744,644**	**72,938,706**	**17,688,893**	**22,786,615**	**71,630,375**	**21,085,513**	**27,242,555**

MCS-MX96	**L11**	**L12**	**L13**	**L14**	**L15**	**L16**	**L17**	**L18**	**K**
H1	34,114	0	90,419	402,140	201,689	317,136	656,963	11,466	
H2	161,868	27,598	273,623	1,264,491	579,634	841,919	1,943,629	71,563	
H3	447,202	16,039	791,605	1,814,527	917,084	1,812,099	2,573,856	296,146	
H4	1,398,529	102,724	1,525,610	2,892,198	939,157	2,990,174	2,513,676	620,562	
H5	2,953,741	218,124	2,689,050	3,433,570	1,150,654	3,637,540	2,560,217	1,193,788	
H6	3,871,040	276,220	3,668,539	3,993,512	1,366,647	3,378,960	1,634,135	2,156,088	
H7	5,674,773	1,051,663	6,894,395	5,828,849	1,620,177	4,017,380	1,747,354	2,900,938	
H8	6,703,625	2,576,092	12,315,227	6,586,017	1,190,213	4,664,227	812,214	4,517,700	
H9	8,801,812	6,657,070	12,800,583	9,355,987	2,301,672	4,586,745	488,344	4,445,333	
H10	17,695,333	30,951,498	10,144,241	29,202,453	1,705,003	8,373,453	184,443	6,284,416	
SOC									1,558,112,676
AAPP									
IIRE									
IIMS									
IP									
IVA									
CS									
PS									
OT									
AHBR									
L1									
L2									
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K									
A1									
A2									
AI									
AII									
AIII									
AIV									
AV									
AVI									
AVII									
AVIII									
AIX									
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C10									
CSC									
CSP									
CEP									
PGRDM									
TLCAN									
RDP									
TOTAL	**47,742,037**	**41,877,028**	**51,193,292**	**64,773,744**	**11,971,931**	**34,619,632**	**15,114,831**	**22,498,001**	**1,558,112,676**

MCS-MX96	A1	A2	AI	AII	AIII	AIV	AV	AVI	AVII
H1									
H2									
H3									
H4									
H5									
H6									
H7									
H8									
H9									
H10									
SOC									
AAPP									
IIRE									
IIMS	3,746,676	22,794,764	29,042,834	-3,521,456	800,877	84,949	2,759,321	5,423,886	8,168,605
IP	319,811	105,114	630,577	209,260	71,082	121,054	380,240	130,396	108,453
IVA									
CS	1,771,377	661,483	2,094,927	1,147,318	276,644	662,129	2,147,693	555,165	347,051
PS									
OT									
AHBR									
L1	90,471	587,467	212,788	216,389	0	287,501	1,369,945	411,747	0
L2	55,604	193,875	437,080	98,078	42,686	160,043	1,234,162	50,843	20,880
L3	1,128	54,907	0	0	0	0	0	0	71,473
L4	0	0	0	70,352	0	497,292	118,877	0	0
L5	581,858	128,111	2,563,799	896,424	17,143	972,148	3,940,106	1,262,334	266,558
L6	15,879,286	16,248	166,326	21,761	105,801	0	51,933	9,360	0
L7	33,128	661,905	1,336,677	1,189,067	150,893	483,158	2,536,298	418,238	462,856
L8	51,578	1,438,839	4,763,595	4,374,080	1,564,871	848,469	1,230,157	2,218,464	804,934
L9	6,790	313,913	1,264,553	2,887,891	126,169	723,784	2,971,033	265,694	802,147
L10	38,811	673,482	1,710,468	571,659	418,494	242,605	1,124,471	449,672	307,145
L11	421,834	492,289	841,346	80,981	154,649	75,831	574,570	87,680	371,109
L12	109,007	620,628	1,732,475	99,055	49,753	754,087	742,171	0	183,593
L13	54,741	750,092	810,059	451,951	28,916	799,394	1,731,804	161,480	102,290
L14	67,364	69,284	3,849,734	230,182	39,409	205,318	3,003,855	124,357	53,686
L15	41,447	0	770,611	80,739	3,044	136,369	27,847	0	0
L16	43,817	221,683	212,381	26,329	33,698	302,013	228,500	17,116	0
L17	12,078	0	0	0	0	0	0	0	0
L18	103,164	346,678	133,488	99,436	11,909	87,800	443,684	36,529	0
K	120,068,213	28,418,388	102,815,880	26,202,334	8,979,581	14,020,010	55,560,267	26,071,394	26,233,148
A1	28,084,519	1,560	132,579,847	2,796,998	4,223,526	499,157	2,427,429	30,451	0
A2	99,564	4,518,292	48,441	52,856	0	72,687	16,885,269	4,306,590	14,757,229
AI	13,921,976	575	57,519,323	3,329,997	12,166	1,165,628	3,570,222	0	0
AII	1,069,750	191,276	1,160,066	37,105,991	1,158,411	342,346	1,647,817	310,398	258,212
AIII	172,316	16,525	41,895	139,234	6,863,217	840,918	154,558	18,580	0
AIV	269,197	79,335	2,600,423	1,290,820	147,036	20,537,560	3,721,074	1,607,792	331,847
AV	14,601,394	1,462,951	5,395,956	13,487,161	1,693,175	3,323,515	76,406,230	4,312,621	3,258,693
AVI	278,593	431,493	2,029,298	32,228	138,021	26,098	1,254,502	5,508,273	427,095
AVII	158,646	569,439	872,620	132,964	229,336	595,149	783,278	407,264	22,943,678
AVIII	2,508,909	3,454,952	7,286,615	1,398,720	1,291,236	1,187,490	3,599,647	2,997,244	6,439,648
AIX	783,517	224,054	25,074	1,181,180	5,577	1,436,729	321,634	6,783	8,243
A4	0	0	0	0	0	0	0	0	0
A5	622,984	675,037	1,271,246	587,462	215,545	1,053,023	6,342,473	2,533,170	2,159,915
A6	3,623,496	2,049,723	14,851,921	9,793,577	4,279,012	3,771,576	11,850,741	2,594,293	4,973,838
A7	1,913,084	2,350,051	8,704,521	4,396,976	2,021,441	1,676,661	7,866,082	1,684,974	2,749,702
A8	1,553,885	647,542	2,396,142	2,293,036	1,075,306	1,516,130	2,663,703	1,204,691	789,588
A9	667,170	988,146	5,546,000	1,119,283	475,733	926,516	3,359,883	1,510,830	851,022
A10									
C1									
C2									
C3									
C4									
C5									
C6									
C7									
C8									
C9									
C10									
CSC									
CSP									
CEP									
PGRDM									
TLCAN	29,303,352	2,803,637	17,315,392	14,531,954	2,403,487	12,773,098	63,011,932	4,305,767	16,085,401
RDP	2,463,225	1,911,096	8,731,296	2,399,644	430,275	1,404,665	17,088,058	1,624,017	6,481,387
TOTAL	**245,593,760**	**80,924,835**	**423,765,674**	**131,501,911**	**39,538,119**	**74,612,898**	**305,131,466**	**72,658,093**	**120,819,425**

MCS-MX96	AVIII	AIX	A4	A5	A6	A7	A8	A9	A10
H1									
H2									
H3									
H4									
H5									
H6									
H7									
H8									
H9									
H10									
SOC									
AAPP									
IIRE									
IIMS	41,412,175	2,409,718	9,042,998	-9,811,545	325,631	3,454,455	16,148,349	3,920,231	0
IP	724,323	65,276	528,296	1,303,453	1,078,075	785,818	1,442,130	1,198,915	487,428
IVA									
CS	3,957,423	381,578	5,086,875	1,000,865	10,899,956	5,906,415	3,180,777	19,828,157	6,782,330
PS									
OT									
AHBR									
L1	2,073,210	473,972	2,786,625	506,206	1,209,771	1,640,706	8,276,244	25,002,223	6,491,882
L2	2,365,269	233,598	1,024,201	1,902,923	1,482,082	1,637,703	3,343,350	16,160,147	3,856,190
L3	0	0	0	26,954	0	0	71,411	48,869,837	488,464
L4	0	0	0	0	279,644	0	732,583	6,902,463	143,432
L5	4,758,361	675,208	2,499,953	551,425	11,124,422	6,891,013	5,556,187	19,611,961	10,641,695
L6	0	21,144	42,588	3,976	224,432	0	8,485	169,789	214,636
L7	5,974,686	160,493	5,195,418	350,492	225,103	626,217	176,492	1,269,510	1,312,585
L8	6,435,055	642,116	21,026,688	992,818	4,342,838	1,320,043	392,842	16,851,907	1,240,927
L9	9,660,903	773,344	133,373	211,434	144,496	76,889	22,047	184,655	145,250
L10	2,336,978	77,679	12,968,941	452,277	1,006,701	298,904	24,554	3,901,635	527,199
L11	1,020,788	0	2,023,712	335,535	3,242,498	34,351,602	178,499	1,035,692	2,219,256
L12	1,396,056	292,159	824,092	2,673,418	4,148,622	3,000,868	2,761,893	10,114,446	12,374,705
L13	2,095,261	200,752	977,701	1,664,350	6,830,614	5,425,192	4,283,337	12,384,841	12,029,490
L14	332,083	147,292	34,951	0	53,298,279	395,163	1,414,606	846,181	139,813
L15	0	4,173	0	160,952	9,870,585	72,130	26,449	623,086	0
L16	377,196	55,473	161,313	88,899	9,798,080	2,106,320	1,645,340	15,305,628	3,232,216
L17	0	0	0	0	88,643	17,173	52,381	14,709,501	0
L18	476,567	32,169	819,802	18,246	934,098	798,545	2,622,599	2,976,186	12,299,719
K	96,336,866	9,524,706	39,337,932	14,611,689	374,067,169	168,494,708	252,205,278	193,684,998	1,480,115
A1	0	595,766	0	5,862	0	0	0	1,622,405	925,524
A2	2,161,175	2,117,411	6,046,711	8,636,385	0	1,043	93,107	51,509	17,069
AI	28,151	208,174	0	4,129	0	0	0	1,850,043	443,155
AII	3,982,616	742,606	693,844	464,965	2,897,916	915,464	359,892	4,523,033	723,849
AIII	6,672,085	302,377	6,163,631	109,494	29,931	9,282	79,332	137,369	16,682
AIV	4,205,845	1,124,279	870,689	315,064	7,635,666	774,401	2,925,409	4,845,698	1,326,555
AV	19,606,291	3,667,904	5,919,447	1,737,228	6,315,471	21,962,176	2,538,050	11,246,254	1,003,069
AVI	7,827,167	874,713	22,346,084	169,030	282,467	103,108	1,675,081	1,870,233	979,700
AVII	42,681,435	1,195,503	20,684,811	164,789	592,271	346,897	171,684	335,773	46,685
AVIII	239,281,879	1,210,845	19,505,373	4,371,290	9,043,751	35,006,882	2,479,048	23,001,390	1,439,046
AIX	2,226,177	10,273,294	796,809	612,366	1,448,485	806,184	4,653,387	7,613,901	2,247,742
A4	0	0	0	0	0	0	0	0	0
A5	2,575,615	149,819	624,086	3,924,757	4,046,441	716,437	3,758,548	1,199,368	2,147,159
A6	38,621,346	2,953,752	10,725,625	4,995,668	14,449,711	12,378,789	4,960,483	11,824,529	2,440,080
A7	17,364,312	1,332,118	11,291,585	1,583,441	19,626,500	21,509,522	4,870,562	13,787,860	4,154,214
A8	8,969,115	744,176	6,753,243	1,112,242	32,752,485	4,607,315	67,966,372	17,748,026	7,292,220
A9	9,528,883	251,759	7,815,065	1,384,923	58,911,470	18,435,038	23,968,765	35,943,537	9,451,527
A10									
C1									
C2									
C3									
C4									
C5									
C6									
C7									
C8									
C9									
C10									
CSC									
CSP									
CEP									
PGRDM									
TLCAN	178,303,101	24,172,154	0	913,478	5,263,684	14,847,991	7,473,021	1,937,279	
RDP	50,089,148	10,468,198	0	0	1,328,076	3,746,286	1,885,513	488,794	
TOTAL	**815,857,540**	**78,555,700**	**224,752,461**	**47,549,479**	**659,246,063**	**373,466,680**	**434,424,086**	**555,578,990**	**110,761,608**

MCS-MX96	**C1**	**C2**	**C3**	**C4**	**C5**	**C6**	**C7**	**C8**	**C9**	**C10**
H1										
H2										
H3										
H4										
H5										
H6										
H7										
H8										
H9										
H10										
SOC										
AAPP										
IIRE										
IIMS										
IP										
IVA	2,217,896	2,484,754	14,430,338	7,437,949	0	10,965,606	3,094,047	2,848,888	33,960,200	12,655,440
CS										
PS										
OT										
AHBR										
L1										
L2										
L3										
L4										
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L11										
L12										
L13										
L14										
L15										
L16										
L17										
L18										
K										
A1	50,612,167	0	414,392	0	0	0	0	0	0	0
A2	1,047,671	0	0	0	0	0	0	0	0	0
AI	281,778,613	0	0	0	0	0	0	0	0	0
AII	0	23,859,182	0	1,043,972	0	0	0	2,019,536	0	4,512,415
AIII	0	0	0	5,521,194	0	0	0	0	0	0
AIV	0	0	8,779	2,005,142	0	0	1,494,802	8,704,562	0	0
AV	0	0	97,095	10,725,892	6,118,704	22,148,212	0	0	0	15,059,125
AVI	0	0	0	13,055,534	0	0	0	0	0	0
AVII	0	0	811,747	0	0	0	0	0	0	0
AVIII	0	0	0	6,896,357	0	25,686,794	8,204,445	0	0	2,584,932
AIX	0	0	429,241	650,213	963,671	0	980,294	1,230,125	0	0
A4	0	0	495,939	0	0	0	0	0	0	0
A5	0	0	12,084,723	0	0	0	0	0	0	0
A6	0	0	0	0	0	0	0	0	333,489,100	0
A7	0	0	0	0	0	142,486,337	0	967,108	0	59,952,199
A8	0	0	233,623,520	0	9,212,847	0	0	0	0	29,502,503
A9	0	541,096	7,071,728	33,142,341	36,763,012	8,389,859	35,116,347	89,181,337	0	21,642,734
A10										
C1										
C2										
C3										
C4										
C5										
C6										
C7										
C8										
C9										
C10										
CSC										
CSP										
CEP										
PGRDM										
TLCAN										
RDP										
TOTAL	**335,656,347**	**26,885,032**	**269,467,501**	**80,478,594**	**53,058,233**	**209,676,808**	**48,889,935**	**104,951,557**	**367,449,300**	**145,909,347**

MCS-MX96	**CSC**	**CSP**	**CEP**	**PGRDM**	**TLCAN**	**RDP**	***TOTAL***
H1							**30,781,621**
H2							**56,536,239**
H3							**71,967,842**
H4							**93,077,637**
H5							**110,933,233**
H6							**140,740,134**
H7							**176,998,468**
H8							**211,586,039**
H9							**301,564,371**
H10							**691,709,834**
SOC							**1,558,112,676**
AAPP							**420,704,346**
IIRE							**118,028,898**
IIMS							**136,202,471**
IP							**9,689,701**
IVA							**90,095,116**
CS							**66,688,160**
PS							**29,427,283**
OT				34,423,120			**42,392,016**
AHBR				16,556,138			**583,558,024**
L1				0			**51,637,146**
L2				22,804			**34,321,520**
L3				359,026			**49,943,200**
L4				0			**8,744,644**
L5				0			**72,938,706**
L6				753,128			**17,688,893**
L7				223,397			**22,786,615**
L8				1,090,154			**71,630,375**
L9				371,147			**21,085,513**
L10				110,879			**27,242,555**
L11				234,167			**47,742,037**
L12				0			**41,877,028**
L13				411,030			**51,193,292**
L14				522,187			**64,773,744**
L15				154,499			**11,971,931**
L16				763,632			**34,619,632**
L17				235,056			**15,114,831**
L18				257,381			**22,498,001**
K							**1,558,112,676**
A1					15,963,940	2,516,942	**245,593,760**
A2					15,602,137	4,346,270	**80,924,835**
AI					18,033,414	8,264,153	**423,765,674**
AII					21,745,593	3,663,727	**131,501,911**
AIII					4,835,887	124,393	**39,538,119**
AIV					3,092,706	886,297	**74,612,898**
AV					22,426,577	14,983,462	**305,131,466**
AVI					7,952,291	1,262,172	**72,658,093**
AVII					13,094,569	8,986,377	**120,819,425**
AVIII					206,438,093	17,229,933	**815,857,540**
AIX					13,295,595	1,747,205	**78,555,700**
A4					0	0	**224,752,462**
A5					861,672	0	**47,549,479**
A6					91,740,645	22,254,855	**659,246,063**
A7					23,245,322	5,638,954	**373,466,680**
A8					0	0	**434,424,086**
A9		41,867,183	91,077,046		7,366,912	1,787,098	**555,578,990**
A10	110,761,607						**110,761,607**
C1							**335,656,347**
C2							**26,885,032**
C3							**269,467,501**
C4							**80,478,594**
C5							**53,058,233**
C6							**209,676,808**
C7							**48,889,935**
C8							**104,951,557**
C9							**367,449,300**
C10							**145,909,347**
CSC							**110,761,607**
CSP							**41,867,183**
CEP							**91,077,046**
PGRDM							**109,890,529**
TLCAN							**395,444,730**
RDP							**110,539,676**
TOTAL	**110,761,607**	**41,867,183**	**91,077,046**	**56,487,744**	**465,695,353**	**93,691,838**	

Appendix 3. The AGEM-MX96

Production

Each Activity *j* (*j=1,…,18*), hires Capital, K_j, and Labor, L_j, to produce Value Added, V_j, through a constant returns to scale Cobb-Douglas technology. Cost minimization implies optimal demands:

$$K_j^* = \left(\frac{V_j}{A_j}\right)\left(\frac{\alpha_{kj}}{p_k}\right)^{1-\alpha_{kj}} \prod_{l=1}^{18}\left(\frac{\left(1+\tau_j^L\right)p_l}{\alpha_{lj}}\right)^{\alpha_{lj}} \qquad \text{(A3.1)}$$

$$L_{lj}^* = \left(\frac{V_j}{A_j}\right)\left(\frac{\alpha_{lj}}{\left(1+\tau_j^L\right)}\right)\left(\frac{p_k}{\alpha_{kj}}\right)^{\alpha_{kj}} \prod_{l=1}^{18}\left(\frac{\left(1+\tau_j^L\right)p_l}{\alpha_{lj}}\right)^{\alpha_{lj}} \qquad \text{(A3.2)}$$

Where, A_j is a (Social Accounting Matrix (SAM) calibrated) scale parameter, and the alphas are (SAM calibrated) share parameters such that $\alpha_{kj} + \sum_{l=1}^{18} \alpha_{lj} = 1$. τ_j^L is the labor tax (social security contributions) implied by SAM data. p_k and p_l are capital price and type *l* labor price.

Average price equal to unitary price (perfect competition) implies that value added price, p_{vj}, is:

$$p_{vj} = \left(\frac{1}{A_j}\right)\left(\frac{p_k}{\alpha_{kj}}\right)^{\alpha_{kj}} \prod_{l=1}^{18}\left(\frac{\left(1+\tau_j^L\right)p_l}{\alpha_{lj}}\right)^{\alpha_{lj}} \qquad \text{(A3.3)}$$

Then, Activities obtain domestic production, Y_{di}, through a Leontief combination of value added, and intermediate consumption X_{ij} (*i=j=1,…,18*). Cost minimization yields optimal quantities:

$$X_{ij}^* = a_{ij} Y_{dj} \qquad \text{(A3.4)}$$

$$V_j^* = v_j Y_{dj} \qquad \text{(A3.5)}$$

Where a_{ij} and v_j are (SAM calibrated) unitary requirements of input *i* and value added, to produce good *j*.

Average equal to unitary price (perfect competition) implies:

$$p_{dj} = \left(\sum_{i=1}^{18} p_i a_{ij} + p_{vj} v_j\right)\left(1 + \tau_j^P\right) \qquad \text{(A3.6)}$$

Where, p_{dj} is domestic production price, and τ_j^P are taxes on production implied by SAM data.

Then, Activities obtain total supply, Y_j, through a CES combination of domestic production, and imports from the RoW, Y_{rj}. Cost minimization yields optimal quantities:

$$Y_{dj}^{*} = \left(\frac{Y_j}{\Phi_j}\right)\left(\frac{\delta_{dj}^{\sigma_j} p_{dj}^{-\sigma_j}}{\left(\delta_{dj}^{\sigma_j} p_{dj}^{1-\sigma_j} + \delta_{rj}^{\sigma_j} p_{rj}^{1-\sigma_j}\right)^{\sigma_j/(\sigma_j-1)}}\right) \qquad \text{(A3.7)}$$

$$Y_{rj}^{*} = \left(\frac{Y_j}{\Phi_j}\right)\left(\frac{\delta_{rj}^{\sigma_j} p_{rj}^{-\sigma_j}}{\left(\delta_{dj}^{\sigma_j} p_{dj}^{1-\sigma_j} + \delta_{rj}^{\sigma_j} p_{rj}^{1-\sigma_j}\right)^{\sigma_j/(\sigma_j-1)}}\right) \qquad \text{(A3.8)}$$

Where, Φ_j is a (SAM calibrated) scale parameter, δ is a (SAM calibrated) share parameter, and σ_j is the (exogenously estimated) Armington elasticity.

Again, average price equal to unitary price (perfect competition), implies:

$$p_j = \left(\frac{\left(\delta_{dj}^{\sigma_j} p_{dj}^{1-\sigma_j} + \delta_{rj}^{\sigma_j} p_{rj}^{1-\sigma_j}\right)^{1/(1-\sigma_j)}}{\Phi_j}\right) \qquad \text{(A3.9)}$$

Where, p_j is total supply goods price, and p_{rj} is (fixed) imports price.

Finally, private consumption goods, C_m, and public consumption goods, D_n, are obtained through a Leontief combination of total supply goods. Cost minimization yields optimal quantities:

$$C_{im}^{*} = z_{im} C_m \qquad m=1,\ldots 10 \qquad \text{(A3.10)}$$

$$D_{in}^{*} = d_{in} D_n \qquad n=1,\ldots 3 \qquad \text{(A3.11)}$$

Where, z_{im} is the (SAM calibrated) unitary requirement of input i, and C_{im}^{*} is optimal demand for inputs. d_{in} is the (SAM calibrated) unitary requirement of input i, and D_{in}^{*} is optimal demand for inputs.

Again, average price equal to unitary price (perfect competition) implies:

$$p_m^{c} = \left(\sum_{i=1}^{18} p_i z_{im}\right)\left(1 + \tau_m^{vat}\right) \qquad \text{(A3.12)}$$

$$p_n^d = \left(\sum_{i=1}^{18} p_i d_{in}\right) \qquad \text{(A3.13)}$$

Where, p_m^c is private consumption good *m* price, and p_n^d is public consumption good *n* price. $\tau_m^{vat}$is the value added tax rate implied by SAM data.

Households

Each representative Household *h* (*h=1,…10*), maximizes a CES utility function of present (C_h) and future (S_h) consumption. Optimal quantities are:

$$C_h^* = \left(\frac{\delta_h}{p_{ch}}\right)^{\sigma_h}\left[\frac{DI_h}{\delta_h^{\sigma_h}p_{ch}^{1-\sigma_h}+(1-\delta_h)^{\sigma_h}p_I^{1-\sigma_h}}\right] \qquad \text{(A3.14)}$$

$$S_h^* = \left(\frac{1-\delta_h}{p_I}\right)^{\sigma_h}\left[\frac{DI_h}{\delta_h^{\sigma_h}p_{ch}^{1-\sigma_h}+(1-\delta_h)^{\sigma_h}p_I^{1-\sigma_h}}\right] \qquad \text{(A3.15)}$$

Where, DI_h is disposable (after tax) income, and p_{ch} is the price of aggregated present consumption of Household *h*, respectively. p_I is the price of investment. δ_h is a (SAM calibrated) share parameter, and σ_h is the (exogenously estimated) elasticity between present and future consumption.

DI_h is given by:

$$DI_h = \left[\sum_{l=1}^{18}\Theta_{hl}p_l\bar{L}_l + \Theta_{hk}p_k\bar{K}(1-\tau^{KT})\right]\left(1-\tau_h^{IT}\right) +$$
$$\Theta_{ht}TR + (\Theta_{hl})e(L_{RoW}) \qquad \text{(A3.16)}$$

Where, Θ_{hl} is Household *h* (SAM calibrated) share in total endowment of labor type *l*, $\bar{L}_l$. Θ_{hk} is Household *h* (SAM calibrated) share in total endowment of capital, $\bar{K}$. τ^{KT} is the tax rate on capital, and τ^{IT} is the income tax (both implied by SAM data). Θ_{ht} is Household *h* (SAM calibrated) share in total transfers, and *TR* are total transfers to Households.

Aggregated price of present consumption, p_{ch}, is the weighted average:

$$p_{ch} = \sum_{m=1}^{10} p_m^c\left(\frac{C_{hm}}{C_h}\right) \qquad \text{(A3.17)}$$

Where C_{hn} is the (optimal) quantity of good *m* consumption by household *h*.

Investment price, p_I, is an average of the prices of the total supply goods, weighted by its participation in total investment:

$$p_I = \sum_{i=1}^{18} p_i \alpha_{Ii}, \quad \text{whith:} \quad \alpha_{Ii} = \frac{p_i INV_i^0}{\sum_{i=1}^{18} p_i INV_i^0} \qquad \text{(A3.18)}$$

Where, INV_i^0 are units of initial investment from Activity *i*.

Finally, Households choose an optimal basket of present consumption goods, C_{hm}, maximizing a Cobb-Douglas utility function. Optimal demands are given by:

$$C_{hm}^{*} = \frac{\beta_{hm} C_h}{p_m} \qquad \text{(A3.19)}$$

Government

Government revenues, GR, are given by:

$$GR = TIT + TPT + TSC \qquad \text{(A3.20)}$$

Where *TIT* are takings from income taxes, *TPT* takings from taxes on production, and *TSC* takings from social security contributions (labor taxes).

On the other hand, government expenditures (GE) are defined as:

$$GE = SE_G + OT_G + SAV_G\ CSC_G + PHC_G + PEC_G + PRoW_G \qquad \text{(A3.21)}$$

Where, SE_G are social expenditures, OT_G are other transfers, CSC_G are public savings, CSC_G are collective services consumption, PHC_G public health consumption, PEC_G public education consumption, and $PRoW_G$ payments to the RoW.

Government expenditures could be greater (or smaller) than its revenues, therefore we define a public surplus as:

$$PS = GR - GE \qquad \text{(A3.22)}$$

Rest of the World

RoW's income, RoWI, is given by:

$$RoWI = \sum_{i=1}^{18} p_i^{RoW} M_i + \theta_{RoW}^{k} \overline{K} + \mathrm{PRoW_G} \qquad \text{(A3.23)}$$

Where, p_i^{RoW} are the (fixed) prices of imports in foreign currency, M_i are imports of good *i*, θ_{RoW}^{k} is the RoW's (SAM calibrated) capital share, and $\mathrm{PRoW_G}$ are payments from the government.

On the other hand, RoW's expenditures, RoWE, are given by:

$$RoWE = \sum_{i=1}^{18} p_i^{RoW} EXP_i + OT_{RoW} + \mathrm{SAV_{RoW}} + \mathrm{L_{RoW}} \qquad \text{(A3.24)}$$

Where, p_i^{RoW} are the (fixed) prices of exports in foreign currency, EXP_i are exports of good *i*, OT_{RoW} are other transfers from the RoW, SAV_{RoW} are RoW's savings, and $\mathrm{L_{RoW}}$ is labor income from abroad.

Closures

Capital and labor endowments are part of the system's constraints: For the base simulations total employment of factors is assumed:

$$\sum_{i=1}^{18} K_i^{*} = \overline{K} \qquad \text{(A3.25)}$$

$$\sum_{i=1}^{18} L_{it}^{*} = \overline{L_t} \qquad \text{(A3.26)}$$

Investment equals savings:

$$\sum_{i=1}^{18} p_i INV_i = \sum_{h=1}^{10} SAV_h + \overline{SAV_k} + SAV_{RoW} + SAV_{GOV} \qquad \text{(A3.28)}$$

Where, SAV_h are Households savings, $\overline{SAV_k}$ are (constant) capital savings, SAV_{RoW} are RoW savings, and SAV_{GOV} are Government savings.

Finally, total supply equals total demand for every good and service:

$$Y_j = \sum_{i=1}^{18} X_{ij} + \sum_{m=1}^{10} C_{mj} + \sum_{n=1}^{3} D_{nj} + EXP_j + INV_j \qquad \text{(A3.27)}$$