

*The Level and Structure  
of Taxation in Mexico: 1895-1990*

Arthur J. Mann

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## Prefacio

El trabajo del Profesor Mann que presentamos a continuación analiza los determinantes de los niveles y la estructura de tributación en México durante el periodo 1895 a 1990. En el mismo se utiliza un modelo econométrico de series de tiempo argumentando que esta metodología es la más adecuada para poder entender los procesos de cambio estructural de las distintas "etapas" del desarrollo económico mexicano. Estos modelos se presentan como alternativos a modelos de corte seccional en la cual se analizan diferentes países, en un momento dado en el tiempo.

Para estos propósitos el Profesor Mann desagrega los componentes de los recaudos contributivos en términos de contribuciones directas, indirectas, del comercio exterior y la seguridad social y analiza la relación de estas variables con indicadores socioeconómicos como lo son el ingreso real per capita, las aportaciones relativas de la producción sectorial, un índice de comercio exterior, la oferta monetaria y las tasas de urbanismo, entre otras. Es interesante notar que el Profesor Mann analiza estas relaciones tanto para el periodo completo (1895-1990) como para subperiodos particulares.

En las conclusiones de su trabajo se discuten los resultados específicos y se contrasta esta metodología con la de los estudios de corte seccional.

### Sobre el Autor

Arthur J. Mann es Catedrático en el Departamento de Economía del Recinto de Río Piedras de la Universidad de Puerto Rico. Ha publicado más de 70 artículos en revistas profesionales. En el campo de la hacienda pública sus artículos han aparecido en revistas tales como *Public Finance Quarterly*, *National Tax Journal*, *Public Finance/Finances Publiques* y en el *Bulletin for International Fiscal Documentation*.

El Dr. Mann ha servido como asesor fiscal ante los gobiernos de muchos países latinoamericanos y ha trabajado como consultor en materias fiscales para el Banco Mundial, el Banco Interamericano de Desarrollo y el Fondo Monetario Internacional.

# THE LEVEL AND STRUCTURE OF TAXATION IN MEXICO: 1895-1990

Arthur J. Mann

## I. Introduction

A great deal of work has been done regarding how the level and structure of taxation are modified during the course of economic development. Due to data deficiencies, which are especially acute in the case of developing countries, most of the studies have necessarily resorted to a cross-sectional approach.<sup>1</sup> Such an approach, however, has definite shortcomings, and is conceptually inferior to a secular time-series methodology. After all, the essence of the tax structure/level and economic development association is change over time in a given country, and the cross-section approach of drawing inferences from multi-country comparisons at one point in time may be a rather poor proxy. Moreover, the cross-section approach of averaging out the various distortions found in the economic and tax systems of the sampled countries may have little relevance to the experience of a particular country, thereby hiding the impact that specific historical forces have on any one country's tax system.

This article adopts a secular and time-series approach to the "determinants" of Mexico's tax level and structure over the period from 1895 to 1990. Some data are also provided for the 1826-1894 interval, but the regression analysis is limited to the former period. By taking a time-series approach, Mexico's tax level and structure are observed at different stages of the economic development

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1. See, for example, Chelliah (1989), Greenaway (1984), Hinrichs (1965), Hitiris (1990), Musgrave (1969), and Tanzi (1987).

process, thereby obviating one of the criticisms directed at cross-sectional analyses.

Section II sketches out the overall trends in Mexico's tax and macroeconomic structure between 1895 and 1990, while at the same time summarizing the most significant tax modifications adopted. Section III describes and justifies the explanatory variables subsequently used in the regressions, and Section IV then analyzes the (regression) relationships between the federal government's gross tax ratio and these variables for time periods which correspond to different phases of the country's economic development. Section V takes a similar regression approach to the "determinants" of tax shares; i.e., types of taxes (direct, indirect, foreign trade, social security). The general conclusions are summarized in Section VI.

## **II. Taxation and Economic Development Patterns**

The data found in Table 1 reveal that 20th century Mexico has experienced both economic growth (real per capita GDP rises--until the early 1980s) and development (structural transformations). Between the late 19th century and the mid-20th century real per capita GDP effectively doubled, and rose again by 150% from mid-century up to the early 1980s, when the external debt crisis broke out. Across the entire period the primary sector (agriculture, livestock,

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forestry, and fisheries) steadily decreased its proportional share of GDP, while manufacturing more than doubled its GDP share from the early 20th century to the last three decades of the period covered here. The openness of Mexico's economy, as measured by the ratio between the sum of merchandise exports and imports to GDP, has varied over time; it constituted about one-fifth of GDP for the first part of the 20th century, but fell well below that figure during the heyday (the quarter century following the early 1950s) of the import substitution model; the late 1970s and the 1980s witnessed a return to pre-1950s levels, with petroleum exports providing the major thrust until the mid-1980s.

## TABLE 1

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FEDERAL GOVERNMENT REVENUE / TAX RATIOS  
AND SELECTED ECONOMIC INDICATORS, 1895-1990

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Sectoral Proportions of GDP

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Period <sup>a</sup>	Gross Recurrent Revenue Ratio	Gross <sup>b</sup> Tax Ratio	Real GDP <sup>c</sup> Per Capita (1949- 51=100)	Primary Sector <sup>d</sup>	Manuf Sector	External Sector <sup>e</sup>
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1895-97	5.0	4.1	52.2	32.6	9.9	16.3
1908-10	3.9	3.0	64.3	27.9	12.1	16.5
1921-23	5.4	4.2	74.3	24.6	10.2	20.3
1929-31	6.4	4.9	66.9	21.2	13.4	17.4
1939-41	7.1	6.0	75.8	19.8	15.1	19.1
1949-51	8.7	7.6	100.0	19.0	17.1	21.1
1959-61	8.6	7.4	130.1	15.9	19.2	14.8
1969-71	10.9	9.8	181.4	11.7	23.1	10.4
1979-81	17.8	17.0	253.2	8.2	22.1	17.8
1988-90	19.1	17.0	235.0	7.8	22.3	23.6

Sources: See Data Sources.

a Three year averages.

b All taxes collected at federal government level, including those shared with states ("participaciones") and those paid for in tax certificates that are reimbursed; includes social security taxes.

c 1970 pesos.

d Agriculture, livestock, forestries, and fisheries.

e Merchandise imports and exports.

The first two columns of Table 1 show that the federal government's gross recurrent revenue and gross tax ratios (revenues and taxes as a proportion of GDP) actually displayed several different but rising plateaus. With reference to the tax ratio, during the first three decades of the 20th century it weighed in at below 5%, as befitting an essentially passive central government. Even after Mexico's industrialization under the import substitution model began in the 1930s, the tax ratio remained below double-digits until the 1970s. This was due to a deliberate public policy of stimulating private sector investment by maintaining low effective tax rates. It was only in the decades of



the 1970s and 1980s that the federal government began to make a more sustained and increased tax effort.

A caveat is called for regarding the revenue/tax ratios. Mexico has a federal system of government, meaning that there exist three levels of government and fiscal powers: federal, state, and municipal (including the federal district). While it is true that these latter two levels have lost a great deal of fiscal power as the 20th century has progressed, they nevertheless do retain both independent and interdependent taxing ability. Adding their revenue/tax ratios to that of the federal government would raise Mexico's overall ratios (i.e., the sum of the federal, state, and municipal ratios) by some 50% until the 1930s, an average of from 30-35% in the 1930s and 1940s, and an average in the 20-25% range since then. It should be noted that in Table 1 the concept of gross tax ratio is used. This means that all those taxes collected by the federal government under tax-sharing agreements ("participaciones") are included as part of the federal government's tax ratio, thereby reducing the discrepancy between Mexico's overall tax ratio and the federal ratio. All regressions reported in Sections IV and V have been run with gross tax collections.

The percentages found in Table 2 yield an appreciation of the evolution of Mexico's tax structure in the 19th and 20th centuries. Not surprisingly, the 19th century witnessed a tax system dominated by import and export duties. Of note, however, is that in the mid-1840s direct internal taxes were of some importance; they consisted of levies on urban and rural property and on business income. Also noteworthy is that direct taxes did not generate larger amounts because of widespread tax evasion. "Countless reports written by contemporary Treasury Ministers testify to a general unwillingness of the

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articulate Mexican public to pay the costs of government except for sales taxes which fell hardest on the poor, and trade taxes which seemed to hurt foreigners and merchants" (Tenenbaum, p.49). Life's three constants--death, taxes, and tax evasion.

TABLE 2

FEDERAL GOVERNMENT GROSS TAX STRUCTURE COMPOSITION, 1826-1990 (%)

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Period	Direct Internal	Indirect Internal	Foreign Trade	Social Security	Total
1826-28	0.2	9.9	89.9	-	100.0
1842-44	11.4	19.8	68.8	-	100.0
1869-71	4.1	20.9	75.0	-	100.0
1879-81	3.1	18.5	78.4	-	100.0
1889-91	5.6	23.0	71.4	-	100.0
1899-1901	5.5	37.8	56.7	-	100.0
1909-11	10.2	32.7	57.1	-	100.0
1919-21	0.6	64.4	35.0	-	100.0
1929-31	10.2	50.3	39.5	-	100.0
1939-41	10.7	49.8	39.5	-	100.0
1949-51	26.2	35.7	32.6	5.5	100.0
1959-61	31.4	29.3	25.4	13.9	100.0
1969-71	35.6	30.6	15.8	18.0	100.0
1979-81	34.6	29.6	22.7	13.1	100.0
1988-90	31.4	52.7	4.2	11.7	100.0

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Sources: See Data Sources.

As the relative importance of foreign trade taxes fell toward the end of the 19th and throughout the 20th centuries (with little change in proportional shares between 1920 and 1950 and a brief upward blip in the late 1970s and early 1980s due to a petroleum export tax), the overall tax ratio was maintained at first by a rising share of indirect taxes and later (post-1940) by an increasing proportional contribution of income and social security taxes (see Table 3). Thus, Mexico's tax structure evolution does conform to a Hinrichs-type model in the transition from pre-modern to modern society. This is also the typology derived from numerous cross-sectional studies.

TABLE 3

RATIOS TO GDP OF TAX STRUCTURE COMPONENTS<sup>a</sup> 1895-1990

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Period	Direct Internal	Indirect Internal	Foreign Trade	Social Security	Total <sup>b</sup>
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1895-97	0.3	1.5	2.3	-	4.1
1908-10	0.3	1.0	1.8	-	3.0
1921-23	0.1	2.8	1.3	-	4.2
1929-31	0.5	2.5	1.9	-	4.9
1939-41	0.6	3.0	2.4	-	6.0
1949-51	2.0	2.7	2.5	0.4	7.6
1959-61	2.3	2.2	1.9	1.0	7.4
1969-71	3.5	3.0	1.5	1.8	9.8
1979-81	5.9	5.0	3.8	2.2	17.0
1988-90	5.3	9.0	0.7	2.0	17.0

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Sources: See Data Sources.

a Gross tax revenues.

b Components may not sum to total due to rounding.

The movement toward post-revolutionary Mexico's modernized tax structure began with the 1925 passage of a schedular income tax. There were seven different schedules: commercial, industrial, and agricultural enterprises, capital income, rents, salaries, and self-employed incomes. In 1965 this schedular income tax was essentially done away with, substituting for it a relatively global business and personal income tax. On the indirect tax front, the tax reforms of the 1947-49 period derogated some 90 different stamp taxes, replacing them with a multi-stage turnover tax ("impuesto sobre ingresos mercantiles"); this tax on general consumption was replaced in 1980 by a value-added tax (VAT). Selective excises (on, among others, tobacco, beverages, and petroleum derivatives) have always been part of the indirect tax burden. Although incipient social

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security systems were in place prior to the 1940s for federal civil servants and the military, the bulk of Mexico's modern day social security system/taxes had its beginning during the 1943-59 period. White and blue collar workers began receiving coverage in 1943 under the Mexican Institute of Social Security (IMSS), which steadily expanded its coverage into the 1970s; other nationwide systems cover government employees (ISSSTE) and housing funds (INFONAVIT).

There have been numerous tax reform cum revenue-enhancing efforts carried out in Mexico in the post-revolutionary period.<sup>2</sup> Two of the most important ones, those of 1925 and 1947-49 have already been cursorily mentioned. Nevertheless, as is apparent from Table 1, by the late 1960s Mexico's tax ratio was relatively low by international standards, especially in view of its level of development and per capita GDP. The 1970s witnessed significant rises in real tax revenues and the tax ratio due to a combination of direct, indirect and social security tax rate increases, inflation-induced bracket creep with regard to income taxes, and the taxation of petroleum exports and production. From Table 1 it may be noted that the gross federal tax ratio (including social security) in the 1969-71 period was 9.8%, and by 1979-81 it had risen to 16.8%. This new plateau was maintained throughout the crisis years of the 1980s, fluctuating within maximum and minimum bands of 19.5% and 15.6%. Beginning in 1983 sea changes did occur in the indirect internal and foreign trade tax ratios (refer to Table 3) without essentially modifying the overall ratio, as taxation on gasoline and hydrocarbons was switched from an export to an indirect orientation. This is the reason for the jump in the

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2. Despite the relative importance of indirect production and consumption taxes, from an equity standpoint in the mid-1970s Mexico's federal tax structure exhibited an essentially proportional tax incidence pattern; see Mann (1982).

indirect internal and the sharp decrease in the foreign trade percentage tax shares between 1979-81 and 1988-90 as observed in Table 2. In sum, Mexico's approach to revenue needs over the entire post-revolutionary period has been via the incremental tax reform avenue.<sup>3</sup> Holistic modifications have not been implemented.

### III. The Explanatory Variables

Any tax system is the product of the interplay between a host of political, institutional, cultural, and socioeconomic factors. In the equations which are subsequently reported (and in those which are not reported due to the lack of statistical significance and/or redundancy), numerous economic, demographic, and institutional/political factors were initially taken into account. With respect to the economic factors, there are essentially two ways in which they interact with and influence a country's tax structure: via modifications in the socioeconomic objectives of tax policy and via the creation of "tax handles" as structural transformations linked to the economic development process occur. The initial selection of ten variables serving as proxies for three broader concepts is listed below and then briefly justified; the number of initial variables was restricted due to the need to generate their values over the extended time periods covered by this analysis.

#### A. Economic Factors

1. Real GDP per capita ( $Y_r / P$ ), where  $Y_r$  = real GDP and  $P$  = population;
2. Foreign trade ratio [  $(M+X) / Y$  ], where  $M$  = merchandise imports,  $X$  = merchandise exports,  $Y$  = nominal GDP;

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3. This proposition is well defended in Bird (1992).

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3. Agricultural sectoral share of GDP ( $A/Y$ ), where  $A$  = agriculture sector value added;

4. Manufacturing sector share of GDP ( $MA/Y$ ), where  $MA$  = manufacturing sector value added;

5. Commerce sector share of GDP ( $C/Y$ ), where  $C$  = commerce sector share of GDP;

B. Monetary Factors

1. Money supply/GDP ( $MS/Y$ ), where  $MS$  = M1 (currency and demand deposits);

2. Rate of inflation ( $IP$ ), where  $I$  = annual rate of change of the GDP implicit price deflator.

C. Demographic/political Factors

1. Degree of urbanization ( $U$ ), where  $U$  = percentage of the total population residing in urban areas;

2. Dependency ratio ( $D$ ), where  $D$  = ratio of the total population less than 15 years of age and over 64 to the number of persons between the ages of 15 and 64;

3. Year after presidential change ( $F$ ), where dummy variables are used.

The use of the real per capita GDP variable is practically self-explanatory in that, as it increases over and above subsistence levels, a country's taxable capacity is enhanced. Of course, the mere existence of tax capacity does not necessarily equate with the political willingness to tap such capacity; this variable was introduced into the regressions with and without a one-year lag. The remaining economic factors relate to the structure of the economy. The foreign trade ratio is a proxy for openness; the import/export sector represents an excellent tax handle for import/export duties,



especially in the first phases of economic development when tax administration deficiencies are especially noteworthy. As economic development unfolds the agriculture sectoral share decreases and that of the manufacturing sector rises. Given that the latter represents a far better tax handle, it would be expected that these structural transformations would be, respectively, inversely and directly associated with higher tax ratios. While there is no reason to expect either a rise or decline in the internal trade (commerce) share of GDP over the course of the development process, it might be postulated that a more modernized sector (with larger retail and wholesale units) would represent a more efficient tax handle. However, this might be obviated by the cultural persistence of small units and the informal sector.

The money supply variable is a proxy for the degree of monetization in the economy, with the hypothesis being that the greater the degree of monetization the larger might be the tax base, especially for indirect taxes. The inflation rate influences the relative price structure, thereby impacting upon tax shares and payments. Moreover, rapidly changing price levels affect tax collections, often via the Olivera-Tanzi effect.

The greater the degree of urbanization the greater is the demand for public services and the easier it should be to collect a given amount of taxes. Additionally, a more literate (i.e. urbanized) population should increase a government's ability to use both direct and indirect internal taxation. With respect to the dependency ratio, the higher its value the greater is the proportion of the total population in unproductive (and non-tax paying) age groups. Finally, presidential terms in Mexico have often historically witnessed substantial modifications in economic and fiscal policy, changes which are commonly implemented at the outset of a new presidential period; a value of 1 is

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assigned to the first year of a new presidential period (beginning in 1923), with zero representing the remaining years.

#### IV. The Level of Taxation

The equations found in Tables 4 and 5 summarize the empirical evidence regarding the "determinants" of Mexico's gross tax ratio (all taxes collected at the federal government level, including social security taxes and those shared with the states). Regressions were run for different time periods: 1895-1990, 1940-1981, and 1895-1910.<sup>4</sup> The former covers the entire period under analysis, but during this interval there occurred definitive breaks in economic policy and in the level of development. Consequently, the 1940-81 interval corresponds to the period of industrialization via import substitution (up to the outbreak of the external debt crisis), while 1895-1910 is linked to pre-revolutionary Mexico. With certain exceptions, only those equations in which the independent variable proved to be statistically significant are reported. Moreover, those equations corresponding to different time periods which generated similar results in each period are not reported.

The results are not surprising, as they correspond well to those generated under inter-country (cross-section) analysis. From the simple regressions of Table 4 it is noted that, for the overall 1895-1990 period (equations 1-7), there emerges a positive (and statistically significant) relationship between the tax ratio and real per capita GDP, the sectoral share of manufacturing, the degree of monetization, the inflation rate, and

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4. The coefficients were determined via an OLS estimation process using SAS. All equations were corrected for first-degree linear autocorrelation employing an autoregressive technique incorporated in the statistical package.

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urbanization. These relationships square well with a priori reasoning, although the exact nature of the inflation rate-tax ratio link is not readily apparent given Mexico's rather mild inflation rate (by Latin American standards) until the late 1970s. Economic development implies that more accessible tax bases grow at proportionally faster rates than real per capita GDP, so that any government demonstrating the political willingness to tap these bases can finance rising demands for public goods. That a negative relationship between the tax ratio and the sectoral share of agriculture emerges is certainly expected, given the declining relative position of this sector during development. Somewhat unexpectedly is that the degree of openness does not emerge as a significant determinant of the level of taxation. This is most likely tied in with the relative closing of Mexico's economy in the post-World War II period.

Two elements of note emerge from the equations run covering the 1940-1981 period. The commerce sectoral share of GDP (equation 8) generated a negative relationship with the tax ratio, due perhaps to

TABLE 4

TAX RATIO DETERMINANTS<sup>a</sup>, 1895-1990  
(t-value in parentheses)

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Equation Period adj. R<sup>2</sup>

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1	1895-1990	-0.051 -(0.009)	+	13.686Y <sub>r</sub> /P (16.865)***	0.78
2	1895-1990	167.039 (11.870)***	-	4.499A/Y (-6.903)***	0.37
3	1895-1990	8.079 (0.392)	+	4.459MA/Y (3.754)***	0.15
4	1895-1990	70.196 (4.571)***	+	0.070 (m+x) / y (1.430)	0.03
5	1895-1990	77.897 (5.029)***	+	2.385 ms / y (2.970)***	0.10
6	1895-1990	75.735 (11.992)***	+	22.892 I (1.99)**	0.05
7	1895-1990	-9.558 (-0.725)	+	2.989 U (8.116)***	0.50
8	1940-1981	220.970 (3.595)***	-	4.078 C (-2.058)**	0.10
9	1940-1981	95.097 (5.795)***	+	0.011 MS/y (0.096)	0.001
10	1895-1910	77.129 (4.446)***	-	14.952 Y <sub>r</sub> / P (-2.402)**	0.31
11	1895-1910	-17.492 (-1.038)	+	1.810 A / Y (3.168)***	0.44
12	1895-1910	64.405 (5.137)***	-	2.457 MA / Y (-2.295)**	0.27
13	1895-1910	37.120 (17.843)***	-	24.406 I (-2.027)*	0.26

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a Dependent variable is the gross tax ratio (taxes / GDP).

\* Statistically significant at the 10 percent level.

\*\* Statistically significant at the 5 percent level.

\*\*\* Statistically significant at the 1 percent level.

Codes for variables in TABLE 4:

Y = gross domestic product(GDP), current prices.  
Y<sub>r</sub> = real GDP.  
P = population.  
A = agriculture sectoral output.

MA	=	manufacturing sectoral output.
C	=	commerce sectoral output.
M	=	merchandise imports.
X	=	merchandise exports.
Ms	=	money supply ( $m_1$ ).
I	=	GDP implicit price deflator
U	=	percent population in urban areas.
D	=	dependency ratio.
F	=	year after presidential change.

its large degree of atomization and subsequent difficulty of taxing it. The monetization variable did not turn out to be significant (equation 9), most likely reflecting the fact that the bulk of the monetization of Mexico's economy occurred prior to 1940.

The four independent variables reported for the period 1895-1910 (equations 10-13) display the exact opposite sign from what might be expected. This is a reflection of the different modes of economic and tax structure in pre-revolutionary Mexico.

It is noteworthy that several variables did not prove to be statistically significant in any of the above time periods. In addition to the already noted case of the foreign trade coefficient, neither the dependency ratio nor the year after a presidential election ever emerged as strongly linked to the level of taxation.

While the simple regressions separately isolate the relationship between a given independent variable and the tax ratio, they do not take into account the possible interaction between multiple variables. After all, as previously argued a tax system and its level result from the interplay of numerous forces.

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Consequently, in Table 5 the possible determinants of Mexico's tax ratio are reported as they emerged from a multiple regression exercise. Those variables which were not incorporated in the final regression run appear without any coefficient estimates.<sup>5</sup>

For the entire 1895-1990 span the most significant determinants of the tax ratio turn out to be the real per capita GDP, the agriculture sectoral share, monetization, and the dependency ratio; the signs fronting these variable coefficients emerged as expected. Somewhat of a surprise was the appearance of the dependency ratio, which had not displayed statistical significance in its simple regression run. The same variables appear as significant in the 1940-1981 equation in addition to the commerce sectoral share, which displays a negative sign. This might give rise to the interpretation that commerce represents a less accessible and lucrative tax base than other sectors (e.g., manufacturing), which grew at proportionally higher rates.

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5. Multiple regression was run using OLS, and initially incorporated all possible independent variables; this yielded  $R^2_{y*x_i}$ . Each independent variable was taken as a function of the remaining variables, with the ensuing regressions yielding  $R^2_{x_i*x_j}$ . If the  $R^2_{x_i*x_j}$  were greater than the  $R^2_{y*x_i}$ , then that independent variable was assumed to be highly related to at least one other independent variable; inspection of the regression results indicated to which variable it was related. Those variables that displayed multicollinearity and had t-values less than 1 (in the initial regression run) were eliminated.

## TABLE 5

MULTIPLE REGRESSION TAX RATIO DETERMINANTS  
(t-values in parentheses)

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Time Period

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Independent Variable	1895-1990	1940-1981
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Constant	208.241 (3.21)***	261.756 (5.16)***
Y <sub>P</sub>	10.824 (5.96)***	8.779 (4.17)***
A/Y	-2.657 (-2.30)**	-3.141 (-2.34)**
MA/Y	-	-
C/Y	-1.965 (-1.44)	-3.116 (-3.33)***
(M+X)/Y	0.067 (1.49)	0.055 (1.54)
Ms/Y	0.089 (1.68)*	0.078 (1.79)*
I	-7.890 (-0.94)	15.585 (1.42)
U	-	-
D	-1.264 (-4.83)***	-1.211 (-5.43)***
F	-	-
R <sup>2</sup>	0.97	0.99
D-W	1.67	2.31

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\*Statistically significant at the 10 percent level.

\*\*Statistically significant at the 5 percent level.

\*\*\*Statistically significant at the 1 percent level. Codes for variables: See Table 4.

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## V. The Structure of Taxation

The discussion now turns to the factors associated with the behavior of the different types of taxes which comprise Mexico's tax structure. All taxes have been placed in four broadly-defined tax categories:

- A. Internal direct taxes ( $T_d$ ), essentially all historical levies on income and capital;
- B. Internal indirect taxes ( $T_i$ ), imposts on transactions, production, and sales;
- C. Foreign trade taxes ( $T_f$ ), duties and other levies on all external goods and services flows;
- D. Social security taxes ( $T_s$ ), the principal ones dating only from 1944.

Tax structure cum tax shares has been defined in two different ways: each broad tax classification as a proportion of GDP and as a proportion of total tax revenue. Similar equations within periods and between periods are not reported.

Table 6 presents the simple regressions run for each tax share for varying time periods. Generally, the results correspond well to what might be expected with respect to the associations between tax shares and the independent variables. The direct tax share (equations 1-9) is inversely associated with agriculture's sectoral share and positively related to real per capita GDP, manufacturing's sectoral participation, monetization, urbanization, the dependency ratio, and the inflation rate; the only puzzling result here is the positive sign on the dependency ratio. Less obvious are the associations which

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crop up between the indirect tax share and the explanatory variables (equations 10-15), which is merely a consequence of any truly solid hypotheses regarding these relationships in the first place. The only direct association is found between  $T_i$  and the inflation rate, and does not lend itself to easy explanation. The remaining relationships are inverse--the indirect tax share with real per capita GDP, openness, the dependency ratio, and manufacturing's sectoral share.

TABLE 6

TAX STRUCTURE DETERMINANTS, 1895-1990  
(t- values in parentheses)

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<u>Equation Number</u>	<u>Period</u>	<u>Dependent Variable</u>	adjusted $R^2$
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1	1895-1990	$T_d/Y$	-10.412 (-3.931)***	+	$5.094Y_r/P$ (12.785)***	0.78
2	1895-1990	$T_d/Y$	0.045 (0.809)	+	$0.024Y_r/P$ (3.120)***	0.11
3	1895-1990	$T_d/Y$	49.664 (10.337)***	-	$1.579A/Y$ (-7.212)***	0.39
4	1895-1990	$T_d/Y$	0.367 (7.322)***	-	$0.009A/Y$ (-4.068)***	0.17
5	1895-1990	$T_d/Y$	-19.452 (-3.419)***	+	$2.357MA/Y$ (7.107)***	0.38
6	1895-1990	$T_d/Y$	18.530 (2.417)**	+	$4.535Ms/Y$ (1.787)*	0.04
7	1895-1990	$T_d/Y$	-12.987 (-3.907)***	+	$1.077U$ (11.581)***	0.67
8	1895-1990	$T_d/Y$	-0.658 (-4.112)***	+	$0.010D$ (5.318)***	0.26
9	1940-1981	$T_d/Y$	25.091 (8.848)***	+	$0.125I$ (3.679)***	0.26
10	1895-1990	$T_i/T$	1.370 (6.115)***	-	$0.011D$ (-4.236)***	0.18
11	1940-1981	$T_i/T$	0.480 (8.622)***	-	$0.017Y_r/P$ (-2.433)**	0.13
12	1940-1981	$T_i/T$	0.561 (4.607)***	-	$0.011MA/Y$ (-1.711)*	0.07
13	1940-1981	$T_i/T$	0.448 (10.356)***	-	$0.001(m+x)/y$ (-2.462)**	0.13
14	1921-1990	$T_i/T$	28.025 (10.909)***	+	$63.310I$ (8.366)***	0.52

continued...

cont...(Table 6)

<u>Equation Number</u>	<u>Period</u>	<u>Dependent Variable</u>	$R^2$
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15	1895-1910	$T_i/T$	0.565 (6.242)***	-	$0.076Y_r/P$ (-2.342)**	0.30
16	1895-1990	$T_F/T$	9.500 (1.995)**	+	$0.051(m+x)/Y$ (2.017)**	0.05
17	1895-1990	$T_F/T$	0.519 (9.209)***	-	$0.034Y_r/P$ (-4.090)***	0.17
18	1895-1990	$T_F/T$	.0503 (16.731)***	-	$0.007U$ (-8.598)***	0.51
19	1940-1981	$T_F/T$	0.744 (9.161)***	-	$0.026MA/Y$ (-6.240)***	0.50
20	1944-1990	$T_s/T$	0.049 (1.774)*	+	$0.008Y_r/P$ (0.476)**	0.15
21	1944-1990	$T_s/T$	0.196 (5.883)***	-	$0.006A/Y$ (2.664)**	0.17
22	1944-1990	$T_s/T$	-0.148 (-3.188)***	+	$0.013MA/Y$ (5.776)***	0.49
23	1944-1990	$T_s/T$	-0.034 (-1.106)	+	$0.004U$ (5.066)***	0.18
24	1944-1990	$T_s/T$	-0.540 (-6.656)***	+	$0.007D$ (8.111)***	0.65

\* Statistically significant at the 10 percent level.  
at the 5 percent

\*\*\* Statistically significant at the 1 percent level.

\*\* Statistically significant

level

Codes for variables in TABLE 6:

- T = total taxes
- $T_d$  = direct taxes
- $T_i$  = indirect taxes
- $T_F$  = foreign trade taxes
- $T_s$  = social security taxes
- $Y_r/P$  = real per capita GDP
- A/Y = agricultural sector's GDP share
- MA/Y = manufacturing sector's GDP share
- Ms/Y = money supply ratio
- U = urbanization rate
- D = dependency ratio
- I = inflation rate, one year lag
- $(m+x)/y$  = foreign trade ratio

Turning to the foreign trade tax share (equations 16-19), an unsurprising direct relationship with external openness emerges. All other reported links are

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inverse, as befits the import substitution model that Mexico adopted until the 1980s. The results pertaining to social security taxes (equations 20-24) emulate those of the the direct tax share. Negatively associated with the agricultural sectoral share, these trust fund levies are positively related to real per capita GDP,

manufacturing's sectoral share, urbanization, and the dependency ratio. As before, only the latter association does not conform to what is expected.

Multiple regressions for each tax classification covering the periods 1895-90 and 1940-81 are found in Table 7; the one equation for social security only includes the years 1944-90. In general, the nature of the relationships (direct or inverse) replicates those found in Table 6, although admittedly the overall results generated here are somewhat disappointing in terms of the number of statistically significant variables which emerge. The most (statistically) significant determinants of direct taxes turn out to be real per capita GDP and the agriculture and commerce sectoral shares. The dependency ratio (with the "correct" sign) emerges as the most important determinant of the indirect tax share, while real per capita GDP, openness, and the degree of monetization are closely linked to foreign trade taxes. Social security taxes are strongly associated with the dependency ratio, urbanization of the population, and openness; this latter association is not easily explained.

TABLE 7

MULTIPLE REGRESSION TAX STRUCTURE DETERMINANTS BY TYPE OF TAX  
(t- values in parentheses)

Independent Variable	<u>Direct Taxes</u>		<u>Indirect Taxes</u>		<u>Foreign Trade Taxes</u>		<u>Social</u>
	<u>1895-1990</u>	<u>1940-1981</u>	<u>1895-1990</u>	<u>1940-1981</u>	<u>1895-1990</u>	<u>1940-1981</u>	<u>Security</u>
							<u>Taxes</u>
							<u>1944-1990</u>

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Constant	10.159 (0.455)***	79.468 (2.651)**	318.355 (4.111)***	133.901 (3.026)***	-108.433 (-2.412)**	-9.662 (-0.182)	-0.268 (-1.993)*
Y <sub>r</sub> P	3.891 (5.019)***	1.129 (0.973)	1.022 (0.421)	2.418 (1.532)	3.341 (2.212)**	4.426 (2.167)**	-0.008 (-1.367)
A/Y	-0.797 (-1.870)*	-2.516 (-3.483)***	-2.768 (-1.899)*	-1.175 (-1.211)	1.130 (1.312)	1.748 (1.377)	0.006 (1.527)
MA/Y	-	-	-	-	-	-	-
C/Y	-0.343 (-0.769)	-1.612 (-2.938)***	-2.717 (-1.718)**	-0.373 (-0.472)	1.471 (1.623)	0.184 (0.190)	-0.001 (-0.167)
(m+x)/Y	0.004 (0.229)	-	-0.066 (-1.144)	-0.043 (-1.543)	0.120 (3.440)***	0.094 (2.663)**	-0.001 (-4.415)***
Ms/Y	0.004 (0.196)	0.039 (1.471)	-0.120 (-1.673)	0.024 (0.598)	0.151 (3.395)***	0.021 (0.456)	-9.180 (-0.042)

cont...

cont...(Table 7)

Independent Variable	<u>Direct Taxes</u>		<u>Indirect Taxes</u>		<u>Foreign Trade Taxes</u>		<u>Social Security Taxes</u>
	<u>1895-1990</u>	<u>1940-1981</u>	<u>1895-1990</u>	<u>1940-1981</u>	<u>1895-1990</u>	<u>1940-1981</u>	<u>1944-1990</u>



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I	-7.586 (-2.720)*	11.198 (1.952)*	12.024 (1.194)	6.015 (0.799)	-7.657 (-1.334)	-7.934 (-0.789)	-1.604 (-1.794)*
U	-	-	-	-	-	-	0.007 (4.132)***
D	0.139 (0.943)	0.180 (1.247)	-1.623 (-4.265)***	-.983 (-4.040)***	0.069 (0.262)	-0.548 (-2.114)**	-0.002 (-2.233)**
F	-	-	-	-	-	-	-
R <sup>2</sup>	0.87	0.96	0.77	0.73	0.31	0.59	0.98
D-W	corrected	corrected	corrected	corrected	corrected	corrected	2.05

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\*Statistically significant at the 10 percent level.

\*\*Statistically significant at the 5 percent level.

\*\*\*Statistically significant at the 1 percent level.

Codes for variables: See Tables 4 and 6.

## VI. Concluding Remarks

This study has analyzed tax ratio and tax structure "determinants" on a time-series basis for one country over a span of almost a century. Such a time-series approach differs from the more commonly adopted cross-section method, which aggregates numerous countries at different per capita income levels as a proxy for economic development and its subsequent relationship to tax evolution.

Taking both tax ratios and tax shares as a function of numerous economic, monetary, and demographic factors, for the case of Mexico there generally emerges:

- A. A positive relationship between the tax ratio and real per capita GDP, the sectoral share of manufacturing, and the degrees of monetization and urbanization.
- B. A negative relationship between the tax ratio and the dependency ratio and the agriculture sectoral GDP share.
- C. An absence of a statistically significant relationship between the tax ratio and the degree of openness, the dependency ratio, and presidential changes.
- D. A positive link between the direct tax share and real per capita GDP, the sectoral share of manufacturing, monetization, and urbanization; the association with the agriculture sectoral share is inverse, but the dependency ratio inexplicably demonstrates a positive relation.

- E. A negative association between the indirect tax share and real per capita GDP, all sectoral shares (agriculture, manufacturing, commerce), openness, and the dependency ratio.
- F. A positive association between the foreign trade tax share and openness, and an inverse link with the dependency ratio and the manufacturing sectoral share; the relation with real per capita GDP switches as a function of simple or multiple regression results.
- G. A positive association between the social security share and real per capita GDP, the manufacturing sectoral share, and urbanization; an inverse link is found with openness and the agriculture sectoral share.

On the whole, these time-series results are essentially quite similar to those found in cross-section analyses of the same issue. However, what cross-section studies cannot account for is that the relationships are not valid for every subperiod within an extended time interval--and time is the essence of economic development. During the 96 years covered by the data for Mexico, the associations often differ between subperiods. This is not at all unexpected, given that both tax handles and tax policy objectives may vary over time in any given country.<sup>6</sup>

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6. A similar phenomenon also occurs in cross-section studies, where the country groupings by per capita income levels may reverse or render insignificant those conclusions reached by use of the overall sample.

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