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ESTIMATING THE TAX BURDEN IN CALIFORNIA

Steven M. Sheffrin and Marla Dresch

The views and opinions expressed in this report are those of the author(s) and do not necessarily represent the California Policy Seminar or the Regents of the University of California.

A Technical Assistance Program Report

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Center for State and Local Taxation
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About the California Policy Seminar

The California Policy Seminar, which funded this study, is a joint program of the University of California and state government that applies university research expertise to state policy concerns. The Seminar sponsors research, conferences, seminars, and publications pertaining to public policy issues in California.

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Data Disk

A diskette of the data in compressed format for IBM-compatible computers is available for $25 from the Institute of Governmental Affairs, University of California at Davis, Davis, CA 95616; for further information contact Shelagh Mackay at (916) 752-2045.

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EXECUTIVE SUMMARY

This summarizes the results of our study of the incidence of state income taxes, sales and use taxes, and residential property taxes for California residents for 1989. In preparing these estimates, we have compiled a sample file of over 5000 family units in California and estimated the taxes paid by each family unit. The data that we use come from a wide variety of sources. Our efforts were assisted by both the Franchise Tax Board and the Board of Equalization, which provided summaries of information that was not publicly available.

Our work focuses on the incidence of the three most significant state taxes in California: the personal income tax, the sales and use tax, and the residential property tax. It does not address the incidence of the state corporation income tax or that portion of the property tax that is levied on nonresidential property, although these may be borne in part by California residents. In restricting ourselves to state taxes, we also do not analyze federal taxes paid by California residents.

This study examines the *economic* incidence of taxes — that is, who truly bears the burden of the tax. Economic incidence may differ from the statutory incidence of the tax, which is defined as the entity that pays the tax. For example, an apartment owner may pay the property tax on an apartment building (statutory incidence), but renters may bear the economic incidence of the tax in terms of higher rents. Economic incidence attempts to measure the true burden of taxation.

In our base case we make three assumptions about the economic burden of taxation:

1. State income taxes are borne by households.

2. Consumers bear the burden of sales and use taxes. Sales taxes paid by business are ultimately passed on to consumers in the form of higher prices.

3. Homeowners bear the burden of property taxes. Renters are assumed to pay 25 percent of the property taxes attributable to their dwelling; the remainder is assumed to be paid by owners of capital in proportion to their capital income.

The first two assumptions are standard in the literature, while the third is similar to assumptions made by the Congressional Budget Office in their work on tax incidence. In order to assess the burden of taxes on California residents an appropriate measure of income is needed, since tax burdens are typically expressed as the ratio of taxes paid to total income. We used a comprehensive measure of annual, money income in our work.

Total income was measured using as a base the annual income information reported for 1989 by family units in the March 1990 Current Population Survey (CPS) for California. Though the CPS gives information on nontaxable as well as taxable sources of income, there are several problems with its measurement of total income: it contains no information on capital gains income, many of its categories of income are underreported, and it is top-coded for levels of income over $100,000. (Top-coding means that incomes above $100,000 are recorded as such, with no further detail.)

These problems were resolved using detailed information provided by the Franchise Tax Board (FTB), which included the probability and level of each category of income reported for federal and state tax purposes for 1989. For households that were not top-coded, the taxable sources of income were adjusted based on information provided by the FTB. For top-coded households, each category of income (e.g., wages, dividends, rents, etc.) was imputed using FTB figures.

Although our measure of yearly income was very comprehensive, income itself may not be a good measure of economic well-being. Income may fluctuate from year to year and over the lifecycle of individuals. Retired persons who are living off of their accumulated savings may have little or no income. People in sales and some other types of vocations and professions may experience wide fluctuations in their level of annual income. For these reasons, it has been argued that some measure of permanent income (i.e., average lifetime income) may be a better indicator of economic well-being. Consumption is one proxy for lifetime income. In our work, we measure tax burdens relative to both consumption and income.

Since we have included capital income in our measure of comprehensive income, the income measures may not give a good indication of economic status at low levels of income. These categories will include "wealthy" households that have capital losses or rental losses for the year. This problem is particularly prevalent in the first income category, less than $5,000 annually. If households with negative capital income were included in the tax incidence study, the average amount of tax as a percent of average income for this income category would be very high and probably not representative of the true tax burden for these households. To alleviate this problem, we did not include negative-income households in the below-$5,000 income category.

Tables 4 and 5 in the report contain our estimates of the incidence of total California taxes and of each of the major taxes. Table 4 uses income as a measuring rod, whereas Table 5 uses total consumption. Estimates are presented as "effective tax rates," which are defined as total taxes in each category divided by the total income or consumption in that category. It is important to note that effective tax rates based on income will always be extremely high for the lower-income categories. Though this problem is somewhat alleviated by not including households with negative income in the lowest income category, effective tax rates for these categories are probably overstated because reported income in those categories is not a good measure of true economic income. Effective tax rates based on consumption are more reliable for analyzing lower-income households, particularly for the lowest two categories.

Measured by income, there is a U-shaped pattern to the effective tax rates. Starting with households in the $10-20,000 range, the effective tax rates begin at 8.5 percent, fall to 6.3

percent, and rise to 9.4 percent. The income tax is progressive, the sales tax is regressive, and the property tax is roughly proportional for incomes of $20,000 and over using our base case assumptions. Measured by consumption, the overall tax system is generally progressive. Lowest-income households pay a higher percentage — as measured by consumption — than do those earning up to $20,000 of income, but then the effective tax rates rise sharply.

Our full report contains a comprehensive account of our data construction and the methods we used to assign income, sales, and residential property taxes to households. It also includes an analysis of alternative tax polices and incidence assumptions.

INTRODUCTION

This study presents estimates of the incidence of state income taxes, sales and use taxes, and residential property taxes on California residents for 1989. In preparing these estimates, we have compiled a sample file of over 5,000 family units in California and estimated the taxes paid by each family unit. The data that we use come from a wide variety of sources, as discussed within the report. Our efforts were assisted by both the Franchise Tax Board and the Board of Equalization, which provided summaries of information that was not publicly available.

Our work focuses on the incidence of the three most significant state taxes in California: the personal income tax, the sales and use tax, and the residential property tax. It does not address the incidence of the state corporation income tax or the portion of the property tax that is levied on nonresidential property, although these may be borne in part by California residents. In restricting ourselves to state taxes, we also do not analyze federal taxes paid by California residents.

In this study we examine the *economic* incidence of taxes — that is, who truly bears the burden of the tax. Economic incidence may differ from the statutory incidence of the tax, which is defined as the entity that pays the tax. For example, an apartment owner may pay the property tax on an apartment building (statutory incidence), but renters may bear the economic incidence of the tax in terms of higher rents. Economic incidence attempts to measure the true burden of taxation.

To assess economic incidence it is necessary to make some assumptions, grounded in economic theory, as to which parties bear the economic burdens of taxes. In addition, it is also necessary to decide how the tax burden will be measured. For example, should it be measured relative to some concept of income or consumption?

In the next section we briefly outline the incidence assumptions used in our base case. We also discuss the issues involved in measuring the tax burden, and then present some overall estimates for the base case.

In subsequent sections we discuss the incidence assumptions in more depth and give results using alternative assumptions. A technical appendix describes our procedures in full detail. It also contains a description of the underlying data for this study, which are available on a diskette. With this data, it is possible to explore the effects of alternative incidence assumptions.

THE BASE CASE

In our base case we make three assumptions about the economic burden of taxation:

1. State income taxes are borne by households.

2. Consumers bear the burden of sales and use taxes. Sales taxes paid by business are ultimately passed on to consumers in the form of higher prices.

3. Homeowners bear the burden of property taxes. Renters are assumed to pay 25 percent of the property taxes attributable to their dwelling; the remainder is assumed to be paid by owners of capital in proportion to their capital income.

Assumptions (1) and (2) are standard and are discussed in more detail in later sections of the report. There is more debate about the incidence of property taxes. Assumption (3) is based on our reading of the "new view" of property taxation. It is also discussed in more detail in a later section of the report.

In order to assess the burden of taxes on California residents an appropriate measure of income is needed, since tax burdens are typically expressed as the ratio of taxes paid to total income. In this study, a comprehensive measure of annual, money income was used. It includes taxable income (wages, business income, interest, rents, dividends, capital gains, alimony, annuities, taxable portion of social security, and unemployment compensation) and nontaxable income (public assistance payments, workers compensation, tax exempt interest, nontaxable social security, veterans benefits). Because of the ability to manipulate rental income for tax purposes, losses of more than $2,000 were excluded from the base of total income.

We considered several issues in choosing an appropriate income base. The first concerns the sources of income to be included. Some studies use only money income, which includes taxable and nontaxable sources. Others try to include non-money income, such as imputed rental income of owner-occupied housing, in-kind government benefits such as food stamps and subsidized government housing, and other non-money transfers, such as employer-provided fringe benefits. There are several problems with using an all inclusive measure of income as the base of a tax incidence study. Non-money sources of income are extremely difficult to measure, and there is little data available to assist in this arduous task. Even without this problem, an income measure that includes non-money sources would not be appropriate for this study because such a measure may not be a good indicator of the ability to pay taxes, particularly if a large portion of income is of the non-money type.

Another consideration is the choice of an appropriate accounting period. For several reasons, income may not be a good measure of economic well-being. Income may fluctuate

from year to year and over the life cycle of individuals. Retired persons who are living off of their accumulated savings may have little or no income. People in sales and some other types of vocations and professions may experience wide fluctuations in their level of annual income. For these reasons, it has been argued that some measure of permanent income (i.e., average lifetime income) may be a better indicator of economic well-being. However, economists have yet to develop an adequate operational measure of permanent income. Some advocate using total consumption as an indicator of permanent income, since total consumption is much more stable than income. Although we report all results as a percentage of total consumption as well as total income, one should be cautioned that estimated consumption expenditures have a larger margin of error than total income.

Total income was measured using as a base the annual income information reported for 1989 by family units in the March 1990 Current Population Survey for California. Though the CPS gives information on nontaxable as well as taxable sources of income, there are several problems with its measurement of total income: it contains no information on capital gains income, many of its categories of income are underreported, and it is top-coded for levels of income over $100,000. (Top-coding means that incomes above $100,000 are recorded as such, with no further detail).

These problems were resolved using detailed information provided by the Franchise Tax Board (FTB). This information included the probability and level of each category of income reported for federal and state tax purposes for 1989, by a scale of total income less negative rents in excess of $2,000. The CPS was broken down into tax units based on age of earners, types of income, home owner's status, and other factors. Each tax unit represented a tax return. If a family unit had no taxable income, then there was no corresponding tax unit for that family. For households that were not top-coded and had positive taxable income, the taxable sources of income were adjusted based on the above-mentioned information provided by the FTB. For top-coded households, each category of income (i.e., wages, dividends, rents, etc.) was imputed using income figures reported for tax purposes.

As noted above, income measures may not give a good indication of economic status. For example, a low-to-zero income level may be the result of unusual circumstances that are unlikely to repeat themselves. Retired persons living off of their savings may have a taxable income that is considerably less then their consumption level. This problem is particularly prevalent in the first income category, less than $5,000 annually. If these negative-income households were included in the tax incidence study, the average amount of tax as a percent of average income for this income category would be very high and probably not representative of the true tax burden for these households. To alleviate this problem, we did not include negative-income households in the below-$5,000 income category. The resulting distribution of total income is contained in Table 1. This imputed income level for each family unit is the base upon which all taxes will be computed.

Table 2 contains a breakdown of total income by earnings (wages, business, and farm income), investment income (taxable and nontaxable interest, dividends, capital gains, rent, retirement, and other), and transfer income (workers compensation, supplemental security, public assistance, veterans benefits, disability, education benefits, child support, social security, unemployment compensation, alimony).

TABLE 1

Distribution of Total Income Less Rents by Income Category

Income Category	Percent of Families in Category	Cumulative Percent
< 5,000	7.4	7.4
5,000-10,000	12.5	19.9
10,000-20,000	18.2	38.1
20,000-30,000	14.4	52.5
30,000-40,000	11.5	64.0
40,000-55,000	12.7	76.7
55,000-70,000	7.6	84.3
70,000-100,000	8.0	92.3
Over 100,000	7.7	100.0

TABLE 2

Income Type As Percent of Total Income by Category

Income Category	Earnings	Investments	Transfer
< 5,000	42.0	4.8	34.4
5,000-10,000	38.7	12.5	44.4
10,000-20,000	59.2	19.0	19.1
20,000-30,000	74.2	15.6	8.8
30,000-40,000	81.1	12.4	4.8
40,000-55,000	81.6	12.9	3.5
55,000-70,000	79.7	16.3	2,5
70,000-100,000	77.0	18.8	2.9
Over 100,000	53.4	43.7	1.7
All	67.6	25.6	5.1

Due to the problems mentioned previously of using income as a base for tax incidence, we also used total household consumption as a measuring rod for taxes. Consumption by California residents was estimated using two microdata sets: the Current Population Survey (CPS) for 1989, which contains detailed income and demographic information on family units in California, and the Consumer Expenditure Survey (CEX) for the western region of the United States, which contains detailed information on consumption expenditures of family units. Consumption expenditures were imputed to representative household units from the CPS using consumption information contained in the CEX. We also made further adjustments, described below, to improve the accuracy of the data.

Consumption expenditures were then identified as being taxable or nontaxable. The major nontaxable categories of consumption in California are food (excluding meals purchased from a restaurant for consumption on-site), services (such as insurance, medical care, entertainment), and prescription drugs. Table 3 gives a breakdown of taxable and nontaxable consumption by income category. Housing expenditures are excluded from our measures of consumption.

TABLE 3

Taxable and Nontaxable Consumption As Percent of Total Income by Category

Income Category	Taxable Consumption As Percent of Income	Nontaxable Consumption As Percent of Income	Total Consumption As Percent of Income
< 5,000	244.4	311.9	556.2
5,000-10,000	59.6	77.2	135.8
10,000-20,000	42.6	57.0	99.5
20,000-30,000	40.7	39.2	79.9
30,000-40,000	30.5	31.1	61.6
40,000-55,000	30.2	26.0	56.3
55,000-70,000	24.6	21.7	46.3
70,000-100,000	23.2	19.7	42.9
Over 100,000	22.9	19.6	42.4
All	29.1	28.0	57.1

TABLE 4

Taxes As Percent of Income

Income Category	Income Tax	Total Sales Tax	Property Tax (Assumption A)*	Total
< 5,000	0.0	30.5	44.2	74.7
5-10,000	0.0	7.7	5.4	13.1
10-20,000	0.3	5.5	2.7	8.5
20-30,000	0.9	4.6	1.8	6.3
30-40,000	1.5	3.5	1.8	6.8
40-55,000	2.2	3.4	1.9	7.5
55-70,000	2.6	2.7	1.8	7.1
70-100,000	3.5	2.5	2.0	8.0
Over 100,000	4.7	2.5	2.2	9.4
All	3.0	3.4	2.3	8.7

TABLE 5

Taxes As Percent of Consumption

Income Category	Income Tax	Total Sales Tax	Property Tax (Assumption A)*	Total
< 5,000	0.0	5.5	4.0	9.5
5-10,000	0.0	5.6	3.9	9.5
10-20,000	0.3	5.5	2.7	8.5
20-30,000	1.1	5.7	2.3	9.1
30-40,000	2.5	5.7	2.9	11.1
40-55,000	3.8	6.0	3.4	13.2
55-70,000	5.5	5.8	3.8	15.1
70-100,000	8.0	5.8	4.6	18.4
Over 100,000	11.2	5.8	5.3	23.3
All	5.2	5.7	3.9	14.8

*See text for assumptions.

Tables 4 and 5 contain the estimates of the tax burden in California for each of the major taxes. Table 4 uses a measuring rod of income, while Table 5 uses total consumption. Estimates are presented as "effective tax rates," which are defined as total taxes in each category divided by the total consumption in that category. It is important to note that effective tax rates based on income will always be extremely high for the lower income categories. Although this problem is somewhat alleviated by not including households with negative income in the lowest income category, effective tax rates for these categories are probably overstated, because reported income in those categories is not a good measure of true economic income. Effective tax rates based on consumption are more reliable for analyzing lower-income households.

Measured by income, there is a U-shaped pattern to the effective tax rates. Starting with households in the $10–20,000 range, the effective tax rates begin at 8.5 percent, fall to 6.3 percent, and rise to 9.4 percent. The income tax is progressive, the sales tax is regressive, and the property tax is roughly proportional for incomes of $20,000 and over using our base case assumptions. Measured by consumption, the overall tax system is generally progressive. Lowest-income households pay a higher percentage than do those with up to $20,000 of income, but then the effective tax rates rise sharply.

In the next three sections of the report we discuss the personal income tax, the sales and use tax, and the property tax in more detail and present results using alternative assumptions. All the technical material is included in the Appendix.

THE PERSONAL INCOME TAX

In order to assess the incidence of income taxes on family units in California, assumptions had to be made about who actually pays income taxes. The most common assumption used in incidence studies, including this one, is that the burden of the individual income tax falls on the taxpayer. This approach can be justified on the basis of two further assumptions: that workers do not work fewer hours and that investors do not change their level of savings in response to the tax. These are also the assumptions used in the classic work on tax incidence by Joseph Pechman and Benjamin Okner at the Brookings Institution.

California income tax was imputed to each tax unit by using information provided by the Franchise Tax Board concerning the probability and mean amount of deductions, exemptions, adjustments, and itemization for both federal and state returns by income category to arrive at a figure of total taxable income. (See Appendix for more information.) The first step was to estimate adjustments to income to get federal adjusted gross income, which is the starting point of the California state tax returns. Deductions, exemptions, and credits were imputed using the information provided by the FTB to get California taxable income. The applicable tax rate was applied to taxable income to calculate the amount of tax due. In 1989,

the tax rate increased from 0 percent for taxable income lower than $50, to 9.3 percent for taxable income in excess of $52,850. Once taxable income was estimated, the income tax was found by multiplying the appropriate tax rate by the amount of taxable income. To obtain the final amount of California income tax paid, renters' credits were subtracted from households that rented their dwelling, and then tax units were aggregated into family units. The total income tax incidence for each family is the total amount of income tax paid divided by the total amount of income in that family.

In presenting our estimates of the burden of California state income taxes, we did not consider the effects of federal deductibility of state income taxes. Although state income taxes are deductible on federal returns for taxpayers who itemize, those who do not itemize receive a standard deduction that implicitly includes some average burden of state income taxes. If one were to consider the consequences of federal deductibility on state income tax incidence, one would need to account for this average burden for the nonitemizers as well as the actual taxes for the itemizers. We did not have sufficient information to make this calculation meaningful and therefore presented data only on actual state income taxes paid by all households. However, in the underlying data for this study, we do make available federal marginal tax rates for each household, which could be useful in estimating the burden of taxes after federal deductibility.

THE SALES AND USE TAX

In 1989, California households, out-of-state tourists, and private industries that did business in California generated $272 billion of taxable transactions for the state of California. Approximately $20 billion of consumption tax revenues were collected from these entities. In this section, we discuss how we estimated the burden of these consumption taxes on California residents.

Consumption taxes have both direct and indirect effects on California households. The direct effects of the consumption tax refer to the amount collected from California residents at the time of the taxable transaction. This amount is either explicitly added to the taxable amount of the transaction, as in the case of the general sales tax, or included in the price of the taxed good, as in the case of most excise taxes.

Consumers also pay taxes indirectly, as a result of taxes imposed on intermediate producers of goods and services. Approximately 35 percent of the sales and use taxes in 1989 were levied on such businesses. The theory regarding the incidence of taxes paid by business is extremely complex. Depending on the nature of the tax, business may respond by either lowering wages and other input costs, raising prices, or decreasing the rate of return to its owners or stockholders. Thus, in principle, taxation of business activity has an indirect effect on the final consumer in the form of higher prices, workers in the form of lower wages, and

investors in the form of lower returns. The indirect effect of taxation is not explicit, as is the direct effect, and hence very difficult to measure.

We attempted to measure both the direct and indirect burden of consumption taxes paid by consumers in 1989, making two key assumptions. First, sales and excise taxes on goods purchased by residents and out of state tourists are borne by the purchasers. Second, businesses pass on the full amount of the tax to their consumers in the form of higher prices. This latter assumption means that the while businesses pay sales and use taxes, the burden of the tax falls on the ultimate consumers of their products. These are standard assumptions in incidence studies.

Methodology, Direct Incidence

The burden of taxes paid by California residents was estimated using the Current Population Survey (CPS) for 1989, which contains detailed income and demographic information on family units in California, and the Consumer Expenditure Survey (CEX) for the western region of the United States, which contains detailed information on consumption expenditures of family units. Consumption expenditures were imputed to representative household units from the CPS using consumption information contained in the CEX. As described in the Appendix, the data were further refined to improve their accuracy.

Consumption expenditures were identified as either taxable or nontaxable. The major nontaxable categories of consumption in California are food (excluding meals purchased from a restaurant for consumption on-site), services (such as insurance, medical care, entertainment), and prescriptions drugs. Table 6 gives the breakdown of taxable and nontaxable consumption by income category, and Table 7 displays this information by total consumption.

Amidst the current budgetary problems, increasing attention has been given to the idea of a sales tax on services as a potential source of additional revenue. Economists generally support taxes on consumer consumption of services. Table 8 gives one an idea of the potential ".revenues that could be earned were such a tax levied on services by California households. Total consumption of personal services, entertainment services, utilities and public services, and medical expenditures were approximately $109.9 billion in 1989. Policymakers may be interested in the burden of sales taxes on services by income class. Table 9 provides information on this issue, as it contains the level of expenditures on personal, entertainment, public and medical services, and nontaxable goods as a percentage of total consumption. Based on this information, the inclusion of services in the sales tax would not make the base of the sales tax more regressive.

In 1989, the state sales and use tax rate was 4.75 percent, and the city and county sales and use tax rate was 1.25 percent, resulting in a statewide uniform sales tax rate of 6 percent. This rate was applied to the taxable sales to get the amount of general sales tax paid by each household. General sales taxes and total excise taxes paid by family units in California as a percentage of income and consumption are contained in Tables 10 and 11.

Excise taxes were computed for tobacco products, alcohol, and gasoline taxes. Our method of allocating these taxes is discussed in the Appendix. Tables 10 and 11 also contain the effective excise tax rate on households as measured by income and consumption, as well

TABLE 6

Taxable and Nontaxable Consumption As Percent of Income

Income Category	Taxable Consumption As Percent of Income	Nontaxable Consumption As Percent of Income	Total Consumption As Percent of Income
< 5,000	244.35	311.19	556.24
5,000-10,000	59.63	77.17	135.8
10,000-20,000	42.55	56.99	99.5
20,000-30,000	40.67	39.22	79.9
30,000-40,000	30.51	31.10	61.6
40,000-55,000	30.24	26.02	56.3
55,000-70,000	24.62	21.67	46.3
70,000-100,000	23.18	19.69	42.9
Over 100,000	22.85	19.58	42.4
All	28.00	29.10	57.1

TABLE 7

Taxable and Nontaxable Consumption As Percent of Total

Income Category	Taxable Consumption As Percent of Consumption	Nontaxable Consumption As Percent of Consumption	Total Consumption As Percent of Consumption
< 5,000	43.93	56.07	100.0
5,000-10,000	43.59	56.41	100.0
10,000-20,000	42.74	57.26	100.0
20,000-30,000	50.91	49.09	100.0
30,000-40,000	49.52	50.48	100.0
40,000-55,000	53.75	46.25	100.0
55,000-70,000	53.19	46.81	100.0
70,000-100,000	54.08	45.92	100.0
Over 100,000	53.85	46.15	100.0
All	50.96	49.04	100.0

TABLE 8

Total Goods and Services Expenditures in Millions of Dollars, 1989

Type of Good or Service	Aggregate Expenditures
Taxable Expenditures	158,598.9
Total nontaxable expenditures	153,454.6
Food	43,597.7
Entertainment Services	23,748.7
Utilities and public services	27,114.7
Personal Services	40,194.6
Medical Services and Prescription Drugs	18,798.7

TABLE 9

Consumption by Category As Percent of Total Consumption

Income	Taxable Goods	Entertainment Services	Personal Services	Medical Services	Food at Home
>5,000	43.9	6.1	19.4	7.4	18.0
5-10,000	43.6	4.5	17.8	10.2	18.3
10-20,000	42.7	5.9	19.3	7.9	18.7
20-30,000	50.9	8.6	16.6	6.0	14.0
30-40,000	49.5	8.5	17.8	6.1	14.3
40-55,000	53.8	6.9	16.7	5.4	13.4
55-70,000	53.2	6.3	18.6	4.7	13.5
70-100,000	54.1	8.8	16.9	5.1	11.7
> 100,000	53.9	8.8	17.2	5.2	11.6
All	51.0	7.6	17.5	6.0	13.0

TABLE 10

Sales and Excise Taxes As Percent of Total Income

Income Category	General Sales Tax	Excise Tax	Total Tax
< 5,000	13.27	4.70	17.97
5,000-10,000	3.17	1.55	4.72
10,000-20,000	2.22	1.03	3.25
20,000-30,000	2.18	0.64	2.82
30,000-40,000	1.66	0.51	2.17
40,000-55,000	1.64	0.46	2.10
55,000-70,000	1.35	0.31	1.66
70,000-100,000	1.30	0.25	1.55
Over 100,000	1.28	0.25	1.53
All	1.59	0.43	2.02

TABLE 11

Sales Tax and Excise Taxes As Percent of Consumption

Income Category	General Sales Tax	Excise Tax	Total Tax
< 5,000	2.39	0.85	3.23
5,000-10,000	2.31	1.13	3.45
10,000-20,000	2.23	1.03	3.27
20,000-30,000	2.73	0.80	3.53
30,000-40,000	2.69	0.84	3.52
40,000-55,000	2.92	0.81	3.73
55,000-70,000	2.91	0.68	3.58
70,000-100,000	3.02	0.58	3.61
Over 100,000	3.01	0.59	3.60
All	2.79	0.76	3.54

as the total for sales and excise taxes together. Measured by income, sales and excise taxes are regressive; measured by consumption they are proportional.

Methodology, Indirect Taxes

In order to assess the impact on consumers of sales taxes levied on businesses, we identified the amount of sales taxes paid by each industry in California using a detailed breakdown of sales tax collections by type of business provided by the state Board of Equalization. The make and use tables of the input/output accounts for the United States were aggregated from 84 industries and commodities to 22, and adjusted so as to reflect California-specific activity. The make table contains information on the amount of each commodity produced by each industry. The use table contains information on the amount of each commodity used by each industry and by final consumers. (See the Appendix for more detail.)

These tables were then used to estimate a matrix of the portion of each industry's output sold to final demand consumers and to other industries. The vector of taxes paid by each industry was then "passed through" this matrix, with the result being the amount of indirect taxes paid by final consumers in the form of higher prices. These amounts were divided by the total industry output level to get indirect tax rates for each industry. The industries in the aggregated input/output tables were then matched to consumption categories in the consumption file. Finally, the indirect taxes paid by California residents was obtained by multiplying the indirect tax rates by the appropriate consumption expenditure. The resulting incidence of direct and indirect sales taxes are contained in Tables 12 and 13.

There may be a large margin of error in these estimates because of information lost in aggregating the input/output tables and the imprecise nature of matching industries with consumption categories. One should keep in mind that these figures are rough estimates of the indirect tax burden borne by California residents.

THE PROPERTY TAX

In this section we discuss the methodology and results of residential real estate tax incidence. We begin with a discussion of the literature regarding property tax incidence, and outline our assumptions about who actually pays property taxes and the California law regarding real estate taxes. We describe our methodology for imputing property taxes to family units in the CPS and then present our results.

There are two basic theories that have been developed regarding the incidence of property taxation, the "traditional" view and the "new" view. The traditional view, popularized by Netzer in 1966, holds that taxes on the improvement portion of a developed piece of property are passed on to the users of that property, while taxes on the land portion of the property are borne by the owner. The assumptions behind this theory are that the supply of

TABLE 12

Direct and Indirect Sales Tax Rate As Percent of Income

Income Category	Direct Tax Rate	Indirect Tax Rate	Total Tax Rate
< 5,000	17.97	12.60	30.54
5,000-10,000	4.72	2.96	7.67
10,000-20,000	3.25	2.20	5.45
20,000-30,000	2.82	1.76	4.58
30,000-40,000	2.17	1.32	3.49
40,000-55,000	2.10	1.25	3.35
55,000-70,000	1.66	1.03	2.69
70,000-100,000	1.55	0.94	2.49
Over 100,000	1.53	0.93	2.45
All	2.02	1.25	3.28

TABLE 13

Direct and Indirect Sales Tax Rate As Percent of Consumption

Income Category	Direct Tax Rate	Indirect Tax Rate	Total Tax Rate
< 5,000	3.23	2.26	5.49
5,000-10,000	3.45	2.16	5.61
10,000-20,000	3.27	2.21	5.48
20,000-30,000	3.53	2.20	5.73
30,000-40,000	3.52	2.14	5.67
40,000-55,000	3.73	2.21	5.95
55,000-70,000	3.58	2.23	5.81
70,000-100,000	3.61	2.19	5.80
Over 100,000	3.60	2.18	5.78
All	3.54	2.20	5.74

land is perfectly inelastic, while the supply of improvements is perfectly elastic (at least in the long run) at the national rental price. Thus, a property tax on improvements acts in much the same way as an excise tax or consumption tax. Likewise, a tax on land acts in much the same way as a tax on capital that is fixed in supply and immobile. According to the traditional view, the property tax is regressive because lower-income families spend a larger portion of their income on housing services than wealthier ones.

The new view recognizes the traditional view as appropriate for analyzing the distributional effects of changes in property taxes by a given locality, but not for the incidence of property taxes for the nation as a whole. In the latter case, the property tax is an element in the cost of using capital goods. If all capital including property is taxed at the same rate, then the incidence of the tax lies with the property owner. If, however, the tax rate on one type of capital is higher than another, investors will respond by shifting resources from the heavily to lightly taxed capital until aftertax returns are equalized. The end result is that the rent for the heavily taxed capital will increase, leaving the burden of tax with the user of the property. Thus, the portion of the property tax that is borne by all types of capital (i.e., the average capital tax rate) is borne by all owners of capital, while the property user, or renter, pays for the amount of tax that is in excess of the average rate. Under the new view the property tax is more progressive because owners of capital are typically in a higher income bracket.

Note that under both views, homeowners pay 100 percent of the property tax since they are the users as well. When property is rented, however, owners and users are different entities and assumptions about incidence must be made.

Economists generally agree with the idea put forth by the new view, that the incidence of the average tax rate of capital lies with the owners of capital, while the portion of tax that is above the average capital tax is borne by the user. However, it is very difficult to assess the average tax rate is for all types of capital. In addition, these results rest heavily on the assumption that the supply of capital is elastic. While this assumption may be valid for other types of capital, it is less so for real estate. To the extent that the supply of real estate is inelastic, property owners will bear the incremental property taxes under the new view, or the improvement portion of taxes under the traditional view. On the other hand, to the extent that users (renters) are immobile and cannot respond to rent increases by moving to lower rent/tax areas, the incidence of the tax will lie with the user.

While most economists accept the new view, they do so with qualifications. It is reasonable to assume that property owners bear a portion of the tax, because the supply of property is fairly inelastic. However, the supply of property is not perfectly inelastic, particularly in the long run, and therefore it seems reasonable that users pay a portion of the tax as well. Thus, we consider two possibilities. Using Assumption A we postulate that renters pay 25 percent of the property tax, while capital owners in general pay the remaining portion; under Assumption B renters pay 50 percent of the property tax while owners of capital pay the remaining 50 percent.

In California, property taxation is dictated by Proposition 13, which was passed in 1977 in response to rapidly increasing property values and hence property tax liabilities. Prior to that time the assessed value of all property (the value upon which property taxes are based) was equal to the current market value of the property. After passage of Proposition 13, the

assessed value of both commercial and residential real property can only be changed if one or more of the following events occur: (1) a transfer of ownership, (2) new construction, or (3) a decline in value. Without one of these events, assessed value increases by the lesser of the inflation rate for the fiscal year or 2 percent. Proposition 13 retroactively rolled back assessed property values to their 1975 value.

As a result of Proposition 13, the amount of property tax paid by property owners depends, among other things, on the base year of the property — the year that the property was purchased or improved. Two similar properties can have very different assessed values if the base years are far apart.

The growth in revenues for a given county will depend on the county's turnover rates (the number of times a property sells in a given period of time), the rate of property appreciation, and the level of new construction. All other things being equal, counties with increasing property values and higher turnover rates will have a larger growth rate in tax revenues then those without. Similarly, growing counties (i.e., those with a lot of new construction) will experience a faster rate of revenue growth than stagnant ones.

The main set of data used to impute property tax to family units was generated from *The Future of Proposition 13 in California*, a study conducted by Arthur O'Sullivan, Terri A. Sexton, and Steven M. Sheffrin (California Policy Seminar, 1993). These data were supplemented with census data for 1989, which include demographic and housing information for family units in California for 1989.

We identified three categories of counties — urban, high-growth, and rural — with each category having a similar turnover, appreciation, and levels of new construction, and hence a similar tax base and distribution of base years for assessed valuation. CPS family units were arranged according to location by these categories. Urban areas describe fairly congested areas in which growth due to new construction is limited because of a scarce supply of buildable land. High-growth areas describe areas that have experienced rapid growth in the past ten years. Assessed property values in high-growth areas will be influenced by both new construction and appreciation of property values. Rural areas describe areas with little growth and abundant land available for expansion. For each type of area we assigned a "representative county," one that experienced similar influences on market and assessed values and for which we have a considerable amount of data with which to make inferences about similar areas. These data came from the Proposition 13 study mentioned above. For urban areas, Los Angeles was the representative county in southern California, and Alameda County was the representative county in northern California. For growth areas, San Bernardino was the representative county for both northern and southern California. For rural counties, Kern and Butte counties were used. Differences in market value between each location and its representative county were accounted for by multiplying the tax liability by the ratio of average market value for the area in question to the average market value for the representative county. Data for this step were found in the Census, which contains estimates of residential market values.

In imputing property tax to the family units in the CPS, we started by distinguishing between home owners and renters. As mentioned above, the incidence of property tax is different for owners versus renters. Owners are assumed to pay 100 percent of the property

tax, while the incidence for renters is less than 100 percent. In addition, there was more detailed data available to impute property taxes to owners than to renters. Thus, methodology for homeowners and renters will be discussed separately.

Data from the Proposition 13 study included mean levels of property tax bills by federal income before tax for single-family residences with home-owner exemptions for Los Angeles, Alameda, San Mateo, and San Bernardino counties. In addition, the average disparity ratio — the ratio of market to assessed value — was available for Butte and Kern counties. For nonrural counties, each family unit was imputed a property tax liability based on the level of California adjusted gross income and the location of the family unit. For rural counties, property tax liability by income classification was not available.

Tax liability was computed as follows: the average market value for each rural area (obtained from Census data) was multiplied by (1/DR), where DR is the average disparity ratio for single-family residences for Butte and Kern counties. DR is the ratio of market-to-assessed value, so multiplying by 1/DR converts market value to assessed value. The average assessed value is then multiplied by the average statewide property tax rate of 1.06 percent to get the average property tax liability. To account for the fact that higher-income families are likely to live in more expensive homes than lower-income families, the average tax liability was multiplied by the ratio of the average property value for each income class to the average property value for all income classes.

As stated above, two assumptions were made regarding incidence of property tax for renters. One is that renters pay 25 percent of the tax on the dwelling they rent, while the remaining 75 percent is paid indirectly by owners of capital. The second assumption is that 50 percent of the tax is borne by the renter and 50 percent is borne by the capital owner.

For renters in single-family residences, the tax liability on the property in which each family lived was estimated in the same way as it was for homeowners. For renters in multifamily dwellings, monthly rent was imputed to each family unit based on its location and level of income using Census data. This rent was annualized and converted to market value. (See Appendix for more detail.) To convert market value to assessed value, the market value was multiplied by (1/DR), where DR is the disparity ratio for the representative county. This amount was multiplied by the average statewide tax rate of 1.06 percent to get the tax liability for the dwelling. According to the assumption used, a portion of this was allocated to the renter, and the remaining portion was aggregated and divided by total capital income (rents, dividends, interest, capital gains, self-employment, and farm income) to get a tax rate for the portion of the tax borne by capital owners.

The results are contained in Tables 14 and 15, which show the effective tax rates measured by income and consumption respectively. The first column of Table 14 presents the incidence results based on the assumption that renters absorb 25 percent of the property tax and owners of capital absorb the remaining 75 percent. Table 15 contains the identical information as measured by consumption.

TABLE 14

Incidence of the Property Tax As Percent of Income with Federal Deduction

Income Category	Property Tax Incidence Under Assumption A*	Property Tax Incidence Under Assumption B*
< 5,000	44.2	51.5
5-10,000	5.4	6.4
10-20,000	2.7	3.2
20-30,000	1.8	2.2
30-40,000	1.8	2.0
40-55,000	1.9	2.0
55-70,000	1.8	1.8
70-100,000	2.0	1.9
Over 100,000	2.2	1.9
All	2.3	2.3

TABLE 15

Incidence of the Property Tax Measured by Consumption

Income Category	Property Tax Incidence Under Assumption A*	Property Tax Incidence Under Assumption B*
< 5,000	4.0	4.6
5-10,000	3.9	4.7
10-20,000	2.7	3.2
20-30,000	2.3	2.7
30-40,000	2.9	3.2
40-55,000	3.4	3.5
55-70,000	3.8	3.9
70-100,000	4.6	4.4
Over 100,000	5.3	4.5
All	3.9	3.9

*For assumptions, see text

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APPENDIX

The Personal Income Tax

As stated in the body of this report, we used as a measure of income annual money income, which has both taxable and nontaxable sources. Our starting point was the annual income information reported by family units in the March Current Population Survey (CPS) for California for 1990. The income categories contained in the CPS include employment income (i.e., wages, self-employment income, etc.), investment income excluding capital gains (i.e., interest, dividends, rental income, etc.), and transfer income (i.e., alimony, social security, unemployment compensation, public assistance). Though the CPS gives information on taxable as well as nontaxable sources of income, there are several problems with its income data; there is no information on income from capital gains, many of its categories of income are underreported, and it is top-coded for levels of income over $100,000.

These problems were resolved using detailed information provided by the Franchise Tax Board (FTB). This information included the probability and level by quintile of each category of income reported for federal and state tax purposes for 1989, by a scale of total income less capital gains and negative rents. The steps of computing total income are outlined below. Income and tax estimates for top-coded units were estimated in the same manner as the units that were not top-coded, but using a separate set of statistics provided by the FTB.

The first step was to put the family units contained in the CPS into tax units where each tax unit represents a tax return. At this step, tax information such as number of exemptions and filing status were determined using information from the CPS on age of earners, and family size and type. Taxable sources of income were identified, and taxable income in the CPS was matched with an equivalent measure of taxable income for the tax-return data. This measure was total taxable income less capital gains and negative rents. Capital gains were omitted because they are not reported in the CPS. Rental losses were excluded because of the potential for taxpayers to manipulate this figure for tax purposes.

For households that were not top-coded and had positive taxable income, the taxable sources of income were adjusted in the following way. The probability of each type of income for the CPS by income category was compared to that of the FTB. In all cases except for social security, the probability of income of FTB data was higher than CPS data. For the CPS units that claimed each type of income, the levels were replaced by figures provided by the FTB. This was done by assigning the mean level of a quintile income level according to the value of a randomly generated number. For example, if the random number generated was .85, then the mean of the 80–100 percentile level of income was assigned to that tax unit. Where the probability of a positive level of a particular income category for the CPS was lower than that of the FTB, income was generated in a similar manner for a randomly selected portion of

households so that after imputation, the probability of each income type for tax units of the CPS matched what was reported by the FTB.

For top-coded households, the discrepancy between the probability of each income type in the CPS versus the FTB was much greater, possibly due to an underrepresentation of wealthy households in the CPS. Each top-coded record was assigned an income category according to the income distribution of top-coded tax returns provided by the FTB. Income was then imputed using income figures of the appropriate income category, as explained for records that were not top-coded.

There may be a different margin of error for the income levels of records that were top-coded versus records that were not. Certain types of income are probably more likely to accompany other types of income on tax returns. For example, a return with positive self-employment income may have a greater probability of reporting rental income or some other type of income than one with no self-employment income. Levels of certain types of income may affect the levels of other types of income as well. This marginal distribution of income types was captured better for records that were not top-coded because there was less of a discrepancy between probability of income types for the CPS versus FTB.

The resulting distribution of Federal Gross Income was compared to that of the federal tax returns and adjusted slightly to correct for discrepancies. This imputed income level for each family unit is the base upon which all taxes will be computed.

The second step in calculating California income tax was to find Federal Adjusted Gross Income, the starting point of the California tax return. Based on the above calculations for each type of income, each return was categorized by the type of return (540, 540A for state returns, 1040, 1040A, and 1040EZ for federal returns) based on the types and levels of income reported and on other characteristics such as homeowner status. The portion of each return type by income category was compared to statistics provided by the FTB. Information on adjustments to income by income category and type of return provided by the FTB was used to generate adjustments to income which was subtracted from Gross Federal Income to get Federal Adjusted Gross Income (FAGI).

The third step was to estimate deductions and itemizations to get taxable income. For those that filed a 1040 form, the probability of itemization by level of FAGI was used to determine which units itemized and which did not. The level of California itemized deduction was imputed to CPS tax units using a random number generator (first random number dictates whether itemization occurs, second dictates level of itemization). All homeowners itemized deductions. Standard deductions and exemptions were subtracted to get California taxable income.

Finally, the applicable tax rate was applied to taxable income to get the amount of tax due. The renter's credit was subtracted from households that rented their dwelling and that fulfilled the relevant requirements, to get the final amount of California Income Tax paid. The tax units were reaggregated into family units, and tax incidence was calculated as the total income tax burden of the family divided by total income, which includes taxable as well as nontaxable sources.

The Sales Tax

Calculation of Direct General Sales Tax

Analysis of consumption expenditures in the CEX were based on family size, presence of children, and income level (federal income before tax). Underreporting of income in the CEX was corrected by scaling income to match the more complete estimation of income in the CPS. The percentage of income spent on each expenditure category for each family type was obtained from the CEX and applied to income measures in the CPS.

Expenditures were then aggregated so as to be comparable to the retail taxable sales reported by the state Board of Equalization (SBE), as well as to the Merchandise Line Sales (MLS) for California prepared by the Census Bureau. The SBE provided us with detailed data on annual taxable transactions by type of retail and business establishment. Each type of retail or business was categorized according to whether its customers would be primarily businesses or households. Information on expenditures by out-of-state tourists from the California Office of Tourism were added to the aggregated consumption expenditures of family units in California and compared to the consumer-oriented, retail taxable sales reported by the SBE, as well as the MLS, which consist of retail sales by type of merchandise. Household consumption was then adjusted so as to match the SBE and MLS figures. Table A1 contains the adjustment factors applied to the various categories of consumption. These factors were multiplied by consumption expenditures for each category to get the adjusted consumption expenditures. Thus, a factor of 1.05 means that consumption expenditures for that category were increased by five percent.

TABLE A1

Adjustment Factors Applied to Various Consumption Categories

Consumption Category	Adjustment Factor
Alcohol consumption at home	1.55
Tobacco products	1.25
Apparel, household appliances, furniture and home decorations, stationery, toys and entertainment products, over-the-counter drugs, other	1.20
Home improvements/gardening equipment, auto and auto accessories, food away from home, computers, gasoline	1.05

Where categories of consumption reported by the SBE were likely to contain business as well as consumer expenditures, such as computers, stationery stores and similar products, expenditures were obtained by taking the residual of reported taxable sales less the estimated amount spent by consumers and tourists. (Some categories of taxable transactions were deemed to be entirely business-generated, such as manufacturing and wholesaling, business services, etc.)

Adjusted consumption expenditures of family units were then identified as taxable or nontaxable, and the general tax rate of 6 percent was applied to the taxable portion.

Gasoline Tax

Consumption expenditures for gasoline in the CEX are aggregated with other motor fluids, such as oil, transmission fluid, etc. Similarly, taxable transactions of service stations included a varied assortment of auto-related products, such as other motor fluids and lubricants, car parts, maps, and the like. In order to assess whether gasoline expenditures for California households as reported in the CEX needed adjustment, additional information was needed to find a) the amount of expenditures on gasoline only by California households, and b) the amount of gasoline consumed by noncommercial users.

The MLS was used to find the gasoline portion of expenditures reported in the CEX, as it contains annual retail sales information for each of the items contained in the CEX expenditure category. The percent of income spent on gas and other motor fluids was multiplied by the percent of gasoline to total motor fluids in the Merchandise Line Sales to get the percent of income spent on gasoline only. Gasoline expenditures by California households were then estimated by multiplying this percentage rate by family income in the CPS. These expenditures by California households were aggregated and added to gasoline expenditures by out-of-state tourists. This figure represents our estimate of noncommercial gasoline consumption in California. This amount was compared to an estimate of nonbusiness gasoline expenditures obtained using data from the U.S. Department of Transportation on *Highway Statistics of 1990* and *National Transportation Statistics*. These publications contain data on total gasoline consumption by state and by type of vehicle (i.e., passenger, bus, commercial bus, etc.). Noncommercial gasoline consumption was assumed to comprise gasoline consumption by passenger and small trucks. An adjustment factor was obtained by dividing this figure by the sum of aggregated California household expenditures and out-of-state tourist expenditures.

The gasoline tax in 1989 was 9 cents per gallon, which corresponds to a tax rate of approximately 9 percent based on a pretax average price per gallon of $1. This rate was applied to our estimate of gasoline expenditures to get the amount of gas tax paid by each family unit.

Cigarette Tax

There are two types of excise taxes on tobacco, one on cigarettes, which was $0.35 per pack in 1989, and another on other types of tobacco products such as cigars, chewing tobacco, pipe tobacco, etc. The rate of tax on other tobacco products is set annually by the SBE so that it is equivalent to the rate of tax on cigarettes. This rate was 41.67 percent for the first half of

1989 and 37.47 percent for the last half. In imputing tobacco taxes to consumer units, we used an approximate average rate of 38.5 percent.

Alcohol Tax

The alcohol tax varies according to type of alcohol. For example, in 1989, the rate was $2.00–4.00/gallon of distilled spirits (depending on the alcohol content), 4 cents per gallon for beer, and 1 to 2 cents per gallon for wine. Because the consumption expenditure data that we used did not distinguish between type of alcohol consumed, an average alcohol tax rate was estimated by dividing total alcohol tax revenues by total alcohol consumption. The estimated rate of taxation was 1.54 percent. This rate was applied to both alcohol consumed at home and alcohol consumed outside of the home.

Indirect Sales Tax

Indirect sales taxes were estimated using detailed information of taxable transactions by business type provided by the SBE, and the input/output accounts for the U.S. economy for 1987. There are two steps in our process. The first involves converting the U.S input/output tables to a California-specific matrix that has as its entries the percentage of output of industry i that is sold to industry j. The second step involves using this table and information on the amount of taxes paid by each industry to compute the amount of sales taxes assessed on nonretail businesses that are passed through to final users.

Step 1: converting U.S. input/output tables

This step involves using the U.S. input/output tables to calculate a California-specific matrix A, where A(i,j) represents the percentage of industry i's output sold to industry j. We started with the make and use tables of U.S. Input/Output tables. The make table gives the dollar amount of each of 84 commodities produced by each of the 84 industries. The use table gives the dollar amount of each commodity used by intermediate businesses and final demand. These tables were aggregated from 84 commodities and industries to 22 commodities and industries, and adjusted to reflect California-specific activity by multiplying the appropriate row/column by the ratio of California Gross State Product for 1987 to U.S. Gross State Product by industry. The 22 categories of commodities and industries used are listed in Table A2.

The make table was adjusted so that each entry, m(i,c), represented the percentage of dollar value of industry i's output that is commodity c. (The sum of the rows of the make table equal 1.) The use table was adjusted so that each entry, u(c,j), represented the percentage of the total dollar value of commodity c used as an input in industry j (or final demand if j>22). If c>22 then u(c,j) represents the percentage of total commodity consumed by final demand.

The adjusted make table was then multiplied by the adjusted use table, so that each entry in the new table represented the percentage of industry i's output purchased by industry j. That is, each entry

$$A(i,j) = \text{Sum over c of } (M(i,c)*Y(c,j))$$

TABLE A2

Industry/Commodity Categories for the Aggregated Make/Use Tables

Item	Description
1.	Agriculture, livestock, forestry, fishery
2.	Metal mining
3.	Crude petroleum and natural gas
4.	Coal, stone, clay fertilizer, chemical mining
5.	Construction
6.	Food and tobacco products
7.	Textiles, apparel
8.	Wood products, furniture
9.	Paper products, printing and publishing
10.	Chemicals, plastics, drugs, paints
11.	Petroleum refining and related industries
12.	Rubber, leather, footwear
13.	Glass, stone and clay products
14.	Metal manufacturing
15.	Nonelectrical machinery, including office equipment
16.	Electrical machinery, household appliances, radio, TV and communication equipment
17.	Transportation equipment
18.	Communications except radio and TV, broadcasting
19.	Transportation, warehousing, wholesale/ retail trade
20.	Electric, gas, water and sanitary services
21.	Services
22.	Government

If J>22, then A(i,j) represents the amount industry i sold to final demand group j (either personal consumption, private investment, exports, imports, or government expenditures). Hence, A is the matrix, whose seller industries are on the rows and buyer industries are on the columns.

To give an illustration, let M be a make table with three commodities and three industries. Industries are on the rows, commodities are on the columns. The sum of row i gives the total industry output for industry i, and the sum of column i gives total output of commodity i by all industries. The following steps were taken to convert the aggregated make table:

1. Each row of the make table is multiplied by the ratio of California Gross Domestic Product to the total industry output of each industry.

2. Each row is divided by the total industry output to get the percentage of industry i's output that is commodity j.

After manipulation, we get a Matrix M*, where rows are industry output and columns are commodity output.

$$M^* = \begin{vmatrix} m_{11} & m_{12} & m_{13} \\ m_{21} & m_{22} & m_{23} \\ m_{31} & m_{32} & m_{33} \end{vmatrix}$$

So, m(i,j)=percentage of industry i's output that is commodity j.

Similarly, the use table, with three industries and final demand, d, and three commodities and value added, is depicted below. Commodities (inputs) are on the rows, and industries are on the columns. U(i,j) represents the dollar value of commodity i used to produce industry j output. If j=4, then U(i,4) represents the dollar value of commodity i consumed by final demand. If i=4, then U(1,j) represents the dollar value of labor used to produce output of industry j. The row totals of the use table give total commodity output, and column totals give total industry output.

$$U = \left| \begin{array}{ccc:c} u_{11} & u_{12} & u_{13} & u_{14} \\ u_{21} & u_{22} & u_{23} & u_{24} \\ u_{31} & u_{32} & u_{33} & u_{34} \\ \hdashline u_{41} & u_{42} & u_{43} & u_{44} \end{array} \right|$$

To adjust the use table, each row entry is divided by the total commodity output to get the percentage of commodity i used by industry j. (Note that adjustment to reflect California-specific activity is not necessary here. One could have adjusted by multiplying each row by the ratio of California-to-U.S. commodity output and then dividing by total California commodity output and the result would be exactly the same.) The result is a matrix U*, where U*(i,j) represents the percentage of commodity i used by industry j. Where j=4, U*(i,4) represents the percentage of commodity i consumed by final demand.

$$U^* = \left| \begin{array}{ccc:c} u_{11} & u_{12} & u_{13} & u_{14} \\ u_{21} & u_{22} & u_{23} & u_{24} \\ u_{31} & u_{32} & u_{33} & u_{34} \end{array} \right|$$

Finally, the adjusted make table is multiplied by the adjusted use table to get A, where A(i,j) is the percentage of industry i's output purchased by industry j , and d(i) represents the percentage of industry i's output sold to final users.

$$A = \left| \begin{array}{ccc} m_{11} & m_{12} & m_{13} \\ m_{21} & m_{22} & m_{23} \\ m_{31} & m_{32} & m_{33} \end{array} \right| * \left| \begin{array}{ccc:c} u_{11} & u_{12} & u_{13} & u_{14} \\ u_{21} & u_{22} & u_{23} & u_{24} \\ u_{31} & u_{32} & u_{33} & u_{34} \end{array} \right| = \left| \begin{array}{ccc:c} a_{11} & a_{12} & a_{13} & d_1 \\ a_{21} & a_{22} & a_{23} & d_2 \\ a_{31} & a_{32} & a_{33} & d_3 \end{array} \right|$$

Note that a(1,2) is the percentage of industry 1's output sold to industry 2.

a(1,2) = (m11*u12) + (m12*u22) + (m13*u32)

Letting C denote commodity, I denote industry,

u12*m11 = (% C1 used by I2)*(% I1's output that is C1)

= % I1's output that is C1 sold to I2

u22*m12 = (% C2 used by I2)*(% I1's output that is C2)

= % I1's output that is C2 sold to I2

u32*m13 = (% C3 used by I2) * (% I1's output that is C3)

= % I1's output that is C3 sold to I2

Step 2: calculating the amount of business taxes passed on to consumers

In Step 2, the table calculated in step one is used to calculate the amount of taxes that is passed through to final users. We start with the vector of consumption taxes paid by businesses, denoted b, where bi represents the dollar value of consumption taxes paid by industry i. We assumed that all taxes are passed on to each industy's consumers. During the first phase, each industry will pass taxes on in the form of price increases to its customers, be they final users or businesses themselves.

Continuing with our example with three industries and three commodities, the amount of taxes passed directly to the consumer in the first phase is d1*b1, where d1 represents the percentage of industry one's output that is purchased by final demand. The amount passed to other businesses is:

$$a11*b1 + a21*b2 + a31*b3 = b1'$$
$$a12*b1 + a22*b2 + a32*b3 = b2'$$
$$a13*b1 + a23*b2 + a33*b3 = b3'$$

or

$$A'*b=b'$$

where b' is indirect taxes passed to businesses from the first phase.

This vector of first-phase taxes will be partly born by consumers and partly born by other businesses, depending on the portion of each industry's output that goes to other businesses verses final demand. Consumers will pay

$$\{d\ .\ b'\}=\{d1*b'1,\ d2*b'2,\ d3*b'3\}'$$

(where "." represents scalar multiplication) or

$$d\ .\ A'*b$$

(where "*" represents matrix multiplication). So the total amount of taxes paid by consumers after the first phase is:

$$(d\ .\ b) + (d\ .\ A'*b)$$
$$d\ .\ (I+A')*b$$

Continuing through this process, consumers ultimately will pay

$$d\ .\ (I + A' + (A') + (A') \ldots\ )*b$$

or

$$d\ .\ Inv(I-A')*b$$

where Inv denotes the inverse of the matrix.

Thus, d . Inv(I-A')*b will be a vector of taxes, with the ith entry telling you the dollar amount of taxes that passed through to final demand for industry i. Stated differently, the ith entry tells you how much industry raised it own prices as a result of

a) taxes assessed on industry i, and
b) price increases of industry i's inputs that resulted from taxes imposed on its inputs of production.

This amount is divided by total industry output to get an indirect tax rate. These tax rates are given in Table A3.

These indirect tax rates were then applied to the appropriate consumption category of family units to get the amount each family unit spent on indirect taxes, as shown in Table A4. (Note: some indirect tax rates were so small that they were not included. The indirect tax rate for industries 7, 8, and 12 were averaged because consumption categories included products from all three industries.) Table A3 shows how each industry from the aggregated input/output table was matched to consumption categories. It should be noted that though some industries had positive indirect tax rates, we were unable to match some industries with consumption categories in the CPS. An example of such an industry is metal mining. The final demand vector represents net exports, private investment, and government demand as well as personal consumption. It is likely that the component of final demand for metal mining is mainly net exports or government consumption.

Property Tax Incidence

To determine the tax liability for each family unit, we used data generated from *The Future of Proposition 13 in California*, conducted by Arthur O'Sullivan, Terri A. Sexton, and Steven M. Sheffrin. The data consisted of mean tax liabilities by federal adjusted gross income for single-family residences that claimed a homeowner's exemption in Los Angeles, Alameda, San Mateo, and San Bernardino counties. In addition, we used average disparity ratios (the ratio of market to assessed value) for various types of properties for Alameda, Butte, Kern, Los Angeles, Placer, Sacramento, San Bernardino, San Mateo, and Sonoma counties.

Where necessary, we obtained additional information regarding market value for those and other counties from PUMS (the Public Use Microsample from the Census), which contains demographic and housing information for family units in California for 1989. This data set includes rental information as well as market value information for homeowners.

We started by distinguishing between homeowners and renters for family units in the CPS. As mentioned, the incidence of property tax is different for owners versus renters. Owners are assumed to pay 100 percent of the property tax, while renters are assumed to pay less than 100 percent. In addition, because different data are available for renters and homeowners, we used a different methodology to impute property tax to homeowners.

TABLE A3

Indirect Tax Rates by Industry

Item No.	Industry Description	Indirect Tax Rate
1	Agriculture, livestock, forestry, fishery	0.3
2	Metal mining	2.8
3	Crude petroleum and natural gas	0*
4	Other mining	0.5
5	Construction	1.9
6	Food and tobacco products	3.5
7, 8, 12	Textiles, apparel wood products, furniture rubber, leather, footwear	4.4
9	Paper products, printing and publishing	5.8
10	Chemicals, plastics, drugs, paints	2.6
11	Petroleum refining and related industries	3.9
13	Glass, stone and clay products	0*
14	Metal manufacturing	0.2
15	Nonelectrical machinery, including office equipment	10.4
16	Electrical machinery, household appliances	2.3
17	Transportation equipment	2.6
18	Miscellaneous manufacturing	0*
19	Transportation, warehousing, whole-sale/retail trade	0.4
20	Electric, gas, water and sanitary services	1.1
21	Services	0.5
22	Government	0.9

* tax rate approximately zero

TABLE A4

Matching of Industry with Consumption Category for Application of Indirect Tax Rates

Item No.	Industry Description	Consumption Category
1	Agriculture, livestock, forestry, fishery	N/A
2	Metal mining	N/A
3	Crude petroleum and natural gas	N/A
4	Other mining	N/A
5	Construction	Home improvements
6	Food and tobacco products	Food, tobacco Products
7, 8, 12	Textiles, apparel Wood products, furniture rubber, leather, footwear	Apparel, household decorations (curtains, carpet, etc.)
9	Paper products, printing and publishing	Books, stationary
10	Chemicals, plastics, drugs, paints	Drugs
11	Petroleum refining and related industries	Gas, household fuel
13	Glass, stone and clay products	N/A
14	Metal manufacturing	N/A
15	Nonelectrical machinery, including office equipment	Computers
16	Electrical machinery, household appliances	Household appliances
17	Transportation equipment	Automobiles/accessories
18	Miscellaneous manufacturing	N/A
19	Transportation, warehousing, wholesale/retail trade	General retail, travel services
20	Electric, gas, water and sanitary services	Utilities, public services
21	Services	All other services
22	Government	N/A

The location of CPS family units are identified by Metropolitan Statistical Areas (MSAs), which are larger geographic areas than counties. Each MSA was matched with the appropriate county and identified as either urban, high-growth, or rural. Urban MSAs are ones that have little buildable land available, and hence limited growth due to new construction. Base years in urban areas are affected mainly by turnover — that is, transfers of ownership rather than new construction. Growth MSAs are ones that have experienced rapid growth in the last ten years, resulting in a significant portion of properties that have a relatively recent base year. Rural areas are areas that have abundant land available but have experienced little growth in the past ten years. Los Angeles County was used as the representative county for urban areas in southern California, and San Mateo and Alameda counties were used as representative urban counties in northern California. San Bernardino was used as the representative growth-county, and Kern and Butte counties were used as the representative rural counties.

For nonrural counties, data on mean levels of property tax bills by federal income before tax for single-family residences with homeowners exemptions were used to impute property tax to home-owning family units based on income level. Each family unit's property tax liability was then adjusted to account for the difference between market values in its MSA and the market value for the representative county/MSA by multiplying it by the ratio of the MSA's average market value to the representative MSA's average market value. These ratios were obtained from PUMS.

For rural counties, the mean market value for each MSA was multiplied by (1/DR) to get the assessed value. (DR is the average disparity ratio for single-family residences in Kern and Butte counties. As the disparity ratio is the market-to-assessed value, (1/DR) is the ratio of assessed to market value.) The average assessed value is then multiplied by the average statewide property tax rate of 1 percent to get the average property tax liability for homeowners in Butte and Kern counties. It is quite likely that wealthier families have higher-valued homes and hence higher tax liabilities, on average, than poorer families. This average tax liability for each home-owning family unit was adjusted to account for this by multiplying it by the ratio of average market value for the appropriate income class to the total average market value. (Again, this ratio was imputed using PUMS data.) As with urban and growth areas, property tax liabilities of rural MSAs not in the representative MSA were adjusted by multiplying by the ratio of the average market value to the average market value of the representative MSA.

For renters in single-family residences, the tax liability on the property in which each family lived was estimated using the same procedure as for home-owners. For renters in multifamily dwellings paying cash rent, monthly rent was imputed to each family unit based on MSA and income using data from PUMS. This rent was annualized and converted to market value by multiplying it by a gross rent multiplier of 11.5, our estimate of the average gross rent multiplier for 1989. (Note, multifamily units are valued using a gross rent multiplier instead of a capitalization rate, which are reciprocal.) Market value was then multiplied by 1 over the average disparity ratio for the representative MSA to get assessed value, which was multiplied by the statewide property tax rate of 1 percent. The amount of property tax borne by renters was estimated to be 25 percent or 50 percent of the total

property tax liability according to the assumptions about who pays property tax (see discussion in the body of the report). The remaining 75 percent or 50 percent was aggregated and divided by total capital income to get an average property tax rate that is applied to capital income.